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POSITION OF BRONCHOESOPHAGOLOGY IN GREAT BRITAIN

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THE SCIENCE OF BRONCHOESOPHAGOLOGY has reached a far higher standard in the United States of America than it has on the continent of Europe or in Great Britain, where it is doubtful if it has even been appreciated as a science, bronchoesophagoscopy having been considered mainly an examination of the bronchus and the esophagus.

Endoscopy in Great Britain is passing through a curious phase. Bronchoscopy (an offspring of laryngology), nurtured by the laryngologists, struggling to live a separate life in the hands of the bronchoesophagologist, is being enticed or, more truly, kidnaped by its grandmother the physician or its foster brother the thoracic surgeon, while esophagoscopy is, to a certain extent, still the province of the laryngologist. Bronchoscopy, therefore, is being divorced from esophagoscopy. That a similar state of affairs is occurring in the United States of America is evidenced by articles appearing in various medical journals, notably that of Lyman G. Richards,[1] of Boston, in the *Annals of Otology, Rhinology and Laryngology.*

It is a strange state of affairs that today laryngologists are discussing the future of bronchoscopy, feeling that it is slipping out of the hands that practiced it and brought it safely to its jubilee (Killian's first publication on the removal of a foreign body appeared in 1897).

During these fifty years compartively little was done in Great Britain to further the science of bronchoesophagology. The addition of this subject to an already large, certainly busy, specialty was burdensome, for there are few who practice laryngology apart from otology. Centralization in bronchoscopic clinics has never matured.

Even in the prebronchoscopic days in my own city of Edinburgh little was done to prepare the way for the introduction of endoscopy. The records show that in 1840 Liston (an Edinburgh surgeon) used a dental mirror to examine the hydropharynx but did not suggest any

Read before the Section on Laryngology and Otology at the Ninety-Sixth Annual Session of the American Medical Association, Atlantic City, June 12, 1947.

1. Richards, L. G.: Endoscopy at the Crossroads, Ann. Otol., Rhin. & Laryng. **51**:791,1942.

mode of illumination. An Edinburgh physician, Dr. Warden, suggested that a prism of flint glass might be used to examine the larynx, and in 1858 another Edinburgh physician, Hughes Bennett, professor of physiology, introduced a rubber catheter into the trachea and bronchus to instil a solution of silver nitrate in the treatment of chronic bronchitis. "That is all."

Not until 1902 was there any enthusiasm for endoscopy in Great Britain. Then Killian[2] contributed a paper, to the British Medical Association, in Manchester, England, on direct endoscopic examination of the lower air and food passages. In his paper he referred to some 20 bronchoscopic procidums reported by Coolidge, Hajek, von Eicken and Neumayer, but none reported from Britain.

In his concluding sentences Killian said:

> I hope that my brief remarks will suffice to convince you of the high value of the direct methods of examination in the diagnosis and treatment of foreign bodies in the esophagus and air passages. May you soon make yourself adept in these methods and you will, I feel sure, do a great service to suffering humanity.

This communication of Killian's seems to have made little impression on the physicians of the day. I can find little reference to the paper apart from the reports of the Section of Laryngology. However, it inspired the laryngologists; communications appeared in medical literature from Waggett of London, Paterson of Cardiff, William Hill, Howarth, E. D. D. Davis and Irwin Moore of London and Brown Kelly, of Glasgow —to mention but a few. Each laryngologist of that time tried his hand at passing a bronchoscope, hoping and praying that a foreign body might lodge itself in a bronchus! There was no question of putting bronchoscopy on a scientific basis—it remained simply a branch of laryngology lower down the anatomic, or should I say social, scale.

Much work was being done on the Continent: in Vienna, Austria; Budapest, Hungary, and Paris, France. Bruning's book on the technic of direct endoscopy[3] was translated and published in 1912 by Howarth and was for a time the textbook of the early endoscopists in Great Britain. No one thought of the bronchoscope otherwise than as a means of removing a foreign body from the lung. The work of Chevalier Jackson, though started in 1904, was known only to a few laryngologists; certainly, the physicians specializing in diseases of the chest continued to think little about the subject.

As an undergraduate I spent much of my spare time in the ear, nose and throat department of the Edinburgh Royal Infirmary with Dr. Logan Turner and was fortunate in seeing a Killian bronchoscope used on

2. Killian, G.: Direct Endoscopy of the Lower Air and Food Passages, Brit. M. J. **2**:569, 1902.

3. Brunings, W.: Die direkte Laryngoskopie, Bronchoskopie und Oesophagospie, Wiesbaden, J. F. Bergmann, 1910.

one or two occasions. During my final examination in the oral examination in systematic medicine I was asked about fibrosis of the lung; I suggested that the bronchoscope might be used in the examination of the lung. This suggestion, far from impressing the examiner was coldly received with the remark that these new-fangled ideas would never help the physician, the inside of the lung could never be examined with a tube, the tube could only help the passage of forceps for the blind removal of a foreign body! That was the opinion of a physician in 1913. I being a Scot, the rebuff rankled, but in later years I was able to demonstrate to this very physician, and his complete satisfaction, that the bronchi could be examined.

In 1913 Turner and Fraser[4] contributed a paper to the Medical Chirurgical Society of Edinburgh—the first announcement of the work being done in the fields of bronchoscopy and esophagoscopy in the wards of the Royal Infirmary, Edinburgh. Though they discussed pathology in dealing with esophagoscopy and included the possibility of treating strictures due to the swallowing of irritants or to malignant disease, they considered the bronchoscope only as a means of removing a foreign body from the bronchus, a procedure which they carried out mainly through a tracheotomy opening or in conjuction with suspension laryngoscopy.

According to the records of the Royal Infirmary, Edinburgh, very little endoscopy was carried out during the war years 1914 to 1918.

In 1919, I returned to Edinburgh on demobilization, and in 1920 Dr. Logan Turner suggested that I should visit Chevalier Jackson's clinic in Philadelphia. I can never forget the kindness which was shown to me. I was the first from my country to visit Dr. Jackson's clinic in the University of Pennsylvania and the Jefferson Hospital, and, like all those who followed me, I fell under the spell of that master of endoscopy to whom physicians owe all their modern ideas on the subject.

I returned home with a new outlook on the use of the bronchoscope and the esophagoscope—the former, no longer an instrument simply for the removal of a foreign body but an essential factor in the diagnosis of diseases of the chest. The old spirit of adventure in passing the tube had disappeared; bronchoscopy was established on a scientific basis.

My colleague, the late Dr. W. T. Gardiner, followed me to America, and on his return we were able to form an endoscopic team—a great advance on the old solo maneuvers. Later Dr. Simson Hall also visited the clinic and continued to work with me until he was appointed a senior surgeon with his own department.

It was soon realized that embryo laryngologists must include in their training schedule the acquisition of a practical knowledge of broncho-

4. Turner, A. L., and Fraser, J. S.: Direct Laryngoscopy, Tracheobronchoscopy and Oesophagoscopy, Edinburgh M. J. **10**:6 and 126, 1913.

esophagology. In order to meet this demand for training the senior laryngologists in some of the larger hospitals devoted a great part of their time to endoscopy, notably in Mr. Negus' clinic in King's College, in the Brompton and Westminister Hospital Clinic under Mr. Ormerod and in our own departments in Edinburgh.

We were handicapped in postgraduate teaching by the fact that practice could be had only on the cadaver or the mannikin. The antivivisection regulations practically prohibited demonstrating the procedure on living animals. For experimental work we could obtain a license to carry out examinations on animals that were under an anesthetic, but a license was not necessary for performing bronchoscopic procedures on dogs under an opiate, though, if we did so, we laid ourselves open to being persecuted and possibly prosecuted by an antivivisectionist.

At a meeting of the British Medical Association, in July 1925, Dr. Chevalier Jackson read a paper to the Section of Otolaryngology on "overlooked foreign bodies in the bronchi."[5] It was a striking tribute to him, with a little glory reflected on the otolaryngologists, that the Section of Medicine postponed their ordinary meeting in order to allow their members to attend his address.

In commenting on this meeting the editor of the *British Medical Journal* said:

> Each and every laryngologist will become his own endoscopist. Every young laryngologist should consider the subject a part of his specialty and train himself to be capable of dealing with any case of foreign body which may come under his care.

The public press became interested in this meeting, and glowing accounts of the "new methods" appeared in the daily papers.

Many laryngologists were encouraged to visit clinics in America and on the Continent, particularly the course in Paris sponsoreed by Chevalier Jackson. In other words, the laryngologist was becoming a part time endoscopist.

The physicians in general practice, as well as those who limited their interest to diseases of the chest, came to realize that more superficial examination of the chest or even roentgenologic examination was not sufficient—"there must be an inside view."

In my own department, as well as in other large ear, nose and throat departments, endoscopists were handicapped for space and by the ever increasing flow of patients with diseases of the ear, nose and throat, and by having to combine endoscopic work with the ordinary routine of the department.

There was little experimental work being done in British clinics, though one must remember the work of Paterson and Brown Kelly on

5. Jackson, C.: Overlooked Foreign Bodies in the Bronchus, Brit. M. J. 2: 686, 1925.

the esophagus, of Ormerod in the diagnosis of cancer of the bronchus and Negus' method of illumination of the esophagoscope, which is universally known and was adopted for the endoscopic instruments supplied to many of the Emergency Medical Service hospitals in England. In Scotland Jackson's instruments were mostly used.

My early experience, from 1921, was obtained mainly in the examination of patients with bronchiectasis. At the close of the First World War there was an influenzal epidemic, leaving in its trail a great many pulmonary abscesses and bronchiectatic cavities. The physicians were only too willing to hand over the patients for examination and treatment. The therapeutic use of the bronchoscope was practically unknown, but we found if we aspirated an abscess of the lung or a bronchiectatic cavity the foul smell from the patient's breath disappeared almost at once and the patient had a certain feeling of well-being. This encouraged us to carry on. We found that in many cases we could not use suction by itself but had to use lavage as well. Most of the early patients had been in the medical wards for some time before we saw them but had had little treatment apart from administration of expectorants and rest, and perhaps a suggestion of postural coughing. The bronchoscopic examination was always done with the patient under local anesthesia. The patients came to the hospital in the morning, were examined and treated by bronchoscopic suction and lavage, and went home the same evening. This, of course, is past history.

In 1929, along with Dr. Simson Hall, I reported the results obtained in 61 cases; in 12 of these the chest was entirely clear, all cases of unilateral bronchiectasis. Dr. Hall had carried out the bacteriologic studies in all these cases, showing the alteration in the flora after bronchoscopic examination and aspiration.[6]

At a later date we worked in conjunction with the thoracic surgeon, carrying out all bronchoscopic examinations and suggesting cases suitable for operation.

I have examined over 160 patients who had bronchiectasis. Many, now, have undergone lobectomy or pneumonectomy.

I am convinced that there should be no attempt at removal of the affected lobe of a lung unless the rest of the chest is entirely clear. In only 1 patient was there what I can term a complete recovery after bilateral lobectomy—a child with so-called congenital bronchiectasis. None of the patients in whom a lobectomy has been done and in whom

6. Martin, G. E.: Bronchoscopic Diagnosis and Treatment of Bronchiectasis and Other Chronic Non-Tubercular Diseases of Chest, Tr. Med.-Chir. Soc. Edinburgh, 1928-1929, p. 152; in Edinburgh M. J., August 1929. Hall, I. S.: Some Observations on Clinical and Bacteriological Aspects of Suppuration of Lung, Tr. Med.-Chir. Soc. Edinburgh, 1928-1929, p. 173; in Edinburgh M. J. September 1929.

the other lung was affected showed any appreciable improvement. In fact, we found that after lobectomy the patient could not carry out effective postural coughing.

A survey of these patients showed that less than 10 per cent had a sinus infection, a finding rather different from that of Welsh and Mayer, who suggested a figure of 66 per cent. But, in agreement with Warner, we found that every patient had a poor nasal airway. In 30 per cent of the patients followed the bronchiectasis followed unresolved pneumonia; from the other 60 per cent we could elicit no history of a coincidental disease.

During the war years we lost sight of a great number of these patients. Our staff was so depleted that in our two departments in the Royal Infirmary, Edinburgh, we had only 6 surgeons on duty altogether, and all of these had Emergency Medical Service appointments as well. In the Royal Infirmary, during these war years, 40,355 new patients with diseases of the ear, nose and throat passed through our hands and over 450,000 return patients had to be seen. There was, therefore, little time for the practice of endoscopy though I tried to devote one day a week to this work.

Fortunately, during the war, in Edinburgh, there was complete cooperation of the ear, nose and throat services of the Navy, the Army, the Air Force and the Emergency Medical Service. The specialists of these services worked together in one large unit on the outskirts of Edinburgh. This unit was equipped for bronchoscopic work through the good auspices of the American Red Cross, the instruments being supplied by Pillings and specially picked by Chevalier Jackson. For this gift we can only express our heartfelt thanks, because any replacement of our own instruments was, and still is, impossible.

Our work now remains much as it was during the second World War apart from the fact that we have more of our assistants back. There has been little chance of rearrangement. The formation of a health service, with the promise of complete cooperation between all the hospitals, has deferred any present plan for the centralization of endoscopic work.

In the University of Edinburgh, under the department of surgery a thoracic unit is being instituted where the thoracic surgeon will do his own bronchoscopic work in cases in which he is going to operate. All patients from the southeastern area of Scotland will be referred to this unit if surgical treatment of the chest is required. but so far no plans have been made to correlate this unit with a department of laryngology.

In the past, in Great Britain, all the larger hospitals and most of the teaching hospitals were voluntary institutions run by voluntary subscriptions. In most cases patients were admitted free, though in some

hospitals a maintenance fee was expected. There was little interchange between the voluntary teaching hospitals and the municipal hospitals, which were run by the municipality with a staff paid for work done in the hospital. Private wards were attached to most of the voluntary hospitals, but in the Royal Infirmary, Edinburgh, there were no such wards. For private patients we had to rely on nursing homes, and though some of these were well equipped, they had not the same facilities for examining patients from the endoscopic point of view as were available in our fitted theater in the Royal Infirmary. Consequently, it was almost preferable to admit private patients into the general wards of this infirmary without thought of remuneration. To a greater or less extent this unsatisfactory method has existed throughout the country. One hates to suggest that a mercenary point of view has an influence on the evolution of a science, but one cannot help but think that the reason of bronchoesophagology has not flourished in Britain is that it has never been on a financial basis in the existing voluntary hospital service. Time alone will tell whether it will be still harder to gain experience in a state-controlled organization.

Up to the present, in all the universities of Britain, teaching of bronchoscopy and esophagoscopy has been the privilege of the laryngologist —part of the course of otolaryngology in the fourth or final year of medicine. So much has to be crowded into this course that usually during his training the student sees only a demonstration of a bronchoscopic examination, from a distance.

Of recent years more and more attention is being paid to postgraduate training.

On demobilization every Service Medical Officer is given the opportunity of taking a course of training. Postgraduate courses in otolaryngology have been instituted, chiefly at the Central London Ear, Nose and Throat Hospital (which has been taken over as a postgraduate training center) and in Edinburgh, where a committee representative of the University, the Royal College of Physicians and the Royal College of Surgeons of Edinburgh is responsible for a series of postgraduate courses. Instruction in bronchoesophagology is available in some centers.

From inquiries covering the main teaching centers in Great Britain it would appear that the average number of bronchoscopic procedures performed per week in each center is from 2 to 4. The average number in Edinburgh is much greater, because in the past there has been some attempt at centralization.

Up to the termination of the war I had recorded 3,500 endoscopic cases.

During the last two years there have been 540 further cases in which work was done. Among these were 64 cases of bronchial carcinoma, all

of which were confirmed by biopsy. The majority of the patients were referred to me from the medical wards in order that roentgenologic findings might be confirmed.

A survey of these cases suggests that no lobe is more liable to become infected than another. Certainly males are affected more readily than females; there were 57 males and 7 females. In only 5 of the cases was the lesion operable; in only 1 of these has the patient survived. The majority of the patients came to us too late.

There can be no doubt that more cases of cancer of the lung are being diagnosed than in the past.

During the past two years particular attention has been paid to the symptoms of cancer of the lung. Medical textbooks rather suggest that the main symptoms are cough and spitting up of blood. In this series only 25 per cent were spitting up blood, 35 per cent complained of pain, 90 per cent complained of cough, 10 per cent were discovered on mass roentgen examination. All the patients complained of a certain amount of breathlessness and an unexplained feeling of tiredness.

The major problem of cancer of the lung is one which the bronchoesophagologist alone can solve. The physician who sees the patient too often waits for a positive roentgenologic report before referring the patient to a thoracic surgeon. I am of the opinion that when a shadow appears on a roentgenogram the lesion is inoperable. Therefore there should be provisions for bronchoscopic examination in every doubtful case if there are cough, slight breathlessness and tiredness.

In the past 2 patients were referred to me because of transient hemoptysis, with cough and slight breathlessness. Though roentgenologically the chest was clear, on bronchoscopic examination there was a small mass. This was removed *in toto* through the bronchoscope, and biopsy revealed carcinoma. One of these patients is alive after ten years. The other died recently from a tumor of the kidney seven years after the removal of the bronchial carcinoma.

I would like to recall one interesting case. A patient who had lupus of the nose in 1929, treated at that time by Dr. Logan Turner with lactic acid, later had lupus of the pharynx, treated with diathermy and later with artificial sunlight. He was apparently well for twenty years. In 1945 he reported, complaining of breathlessness. Bronchoscopic examination showed a small ulcer limited to the last half centimeter of the trachea and the first centimeter of the left bronchus. Sections of this ulcer showed lupus. I cauterized the ulcer with diathermy. Since then the patient has been in a sanatorium and is reported as quite fit.

During the same period I have examined 62 patients who had carcinoma of the esophagus. These patients have all been examined in con-

junction with the roentgenologic department. Of the lesions, only 2 were postcricoid.

It is curious how the site of cancer of the esophagus seems to have altered in recent years. I remember in 1920 assisting Dr. Logan Turner in the publication of a review of cases of cancer of the esophagus examined up to that time. In that series the majority of the cancers in women were postcricoid. In these 2 recent cases one of the postcricoid lesions was in a male and one in a female. When I published a résumé of cases encountered between 1920 and 1930, the highest percentage of patients showed an involvement of the lower end of the esophagus. During the last two years the majority of patients had a cancer of the middle third of the esophagus.

So far few patients with esophageal cancer have been seen early enough to allow of operative intervention. In only 3 cases (in which the tumor was at the lower end) was it possible for the surgeon to do a partial gastrectomy, removing the lower end of the esophagus and swinging the stomach up to the esophagus by the transthoracic route. The result in 2 of these cases has been perfect so far.

Recently we have returned to the use of the radium bougie. Dr. Court Brown, one of the radiotherapeutists, has interested himself in the cases in which the bougie has been used and has followed them up.

The great problem encountered when a radium bougie is used in the treatment of carcinoma of the esophagus is that the dosage falls off rapidly in the tissues, so that while an adequate dose may be delivered to the surface it is extremely difficult to deliver an adequate dose to the depths. The percentage depth dose can be increased by increasing the diameter of the bougie.

In the past the advocates of this form of treatment used bougies of small external diameter. In this way only an adequate surface dose was delivered, and the inadequacy of the depth dose resulted in recurrence. It was decided, therefore, to use a bougie of the greatest possible diameter compatible with the feasibility of its being introduced into the site of the tumor and with the patient's being fit enough to tolerate the treatment.

A radium bougie of an external diameter of 1 cm. is used containing 60 mg. of radium. The length of the radioactive source is 12.3 cm. and the filtration is 1 mm. of platinum. With a radium-tumor distance of 0.5 cm., the surface dose rate is 166.6 roentgens per hour, and the dose rate at a depth of 1.5 cm. from the center of the radium source is 52.6 per hour. The surface dose is 10,000 r, and 3,160 r is delivered at 1.5 cm. distance from the radium source. The length of the time of treatment is sixty hours. This time of treatment is divided into two periods with

a fortnight's interval between periods. Each period is subdivided into five daily fractions, the length of a daily fraction being six hours.

In considering the results of treatment we have excluded all cases of adenocarcinoma of the lower third of the esophagus, owing to the difficulty in many cases of deciding whether the tumor has arisen primarily in the esophagus or primarily in the fundus of the stomach.

Since the technic of treatment just described was adopted, 32 patients with primary carcinoma of the esophagus have been referred to the department for treatment, and 30 (48.5 per cent) were found to be suitable for bougie treatment. Factors which militated against the treatment were age, poor general condition, excessive length of the tumor (over 5 cm.) and the inability at the time of esophagoscopy to pass the bougie through the lumen of the tumor.

In a number of cases it has apparently been possible to destroy the primary tumor, and the subsequent roentgenologic examination has shown the esophagus to be normal in appearance at the site of the tumor. In the majority of the cases, however, metastases have developed. Nevertheless the patients had normal swallowing up to the time of death, and a useful palliative result was obtained. In cases in which this modicum of success was attained, the length of the primary tumor tended to lie between 2 and 4 cm. In the most successful case in the series—the patient has now remained well for over two years—the length of the primary tumor was 2 cm. It appears reasonable to suppose that if patients could be referred for treatment at an early stage, the tumor not being more than 4 cm. in length, the radium bougie treatment would be effective in curing a greater proportion of them.

It is interesting to note the number of patients with congenital shortening of the esophagus who have been referred to me from the medical wards for examination. In the past, patients with this condition were considered symptomless up to the age of about 60. Now such patients seem to be showing signs of discomfort at a much earlier age. Mr. Allison, of Leeds, England, in a recent paper suggested that without any history of trauma it is rather difficult to believe that a patient can show gastric mucosa 1/2 to 1 inch (2.5 cm.) above the diaphragm with, in many cases, a small peptic ulcer at the junction of the esophageal and gastric mucosa. Usually the complaint is that slight pain comes on between the shoulders shortly after swallowing and disappears on continued deglutition. The small peptic ulcer disappears after the area is painted with a 1 per cent solution of methylrosaniline chloride (gentian violet) or the patient is given some of this solution, diluted, to drink for a day or two after the examination.

I think that shortness of the esophagus is mainly a congenital defect and that symptoms are showing at an earlier age because of the definite

aging of the population of Great Britain with the war and the postwar years, an oversufficiency of carbohydrates, a too monotonous diet and probably overloading of the stomach at meal times with starchy foods, such as bread and potatoes, because of the lack of dairy produce, the small meat ration and the balance of fruit.

During these last two years there have been only 3 cases of foreign body of the bronchus, while there have been 38 cases in which the esophagus was involved. Altogether, during my twenty-five years' experience I have removed only 30 foreign bodies from the bronchi and 310 from esophagi.

The apparent difference in the number of intrabronchial foreign bodies between our two countries has always been a matter for debate. My own patients are drawn from the southeast part of Scotland with a population of about 1,000,000. Other clinics report a similar small number. Perhaps the highest figure is that given by the special foreign body clinic (abandoned during the war) run by Mr. Cawthorne for the London County Council.

If the future endoscopic practice of the larynologists is to be confined to the removal of foreign bodies, then about 1.2 bronchoscopies and 11.4 esophagoscopies would cover the endoscopic requirements of each center in the year. One wonders if Killian, when he gave the peroration to his address in Manchester, visualized that the bronchoscope would have to be so little used for the removal of foreign bodies.

Three questions are foremost in the minds of those who have given much of their time to endoscopy.

1. Is all endoscopic work gradually to pass into the hands of the thoracic surgeon?

2. If it does, will bronchoesophagology slip into the past, with no one to carry out its precepts?

3. Who is to teach endoscopy? Can one divorce the lower air passages from the upper? Can one forget about the mouth, the hypopharynx and the larynx in the rush to pass a tube into the lower air and food passages?

At present patients are referred to the thoracic surgeon for operation. Naturally, he will examine the bronchus and the esophagus of every patient—but what of the number for whom a bronchoscopic examination should be part of the diagnostic inquiry?

I have invited the opinions of some of the senior laryngologists throughout Britain. The centers listed here are well known to those of you with whom we had the pleasure of working during the war. For purposes of clarity I have epitomized the reports in geographic order.

Newcastle: Dr. F. McGucken reports that in his own clinic about three bronchoscopic examinations are carried out per week. There is a large thoracic unit

apart from the main hospital, and there the bronchus and esophagus are examined by the thoracic surgeon before operation. There is no liaison between the two departments.

Leeds: During the war the present senior surgeon, Mr. G. S. Seed, was on service as was his assistant surgeon. A bronchoscopic section was therefore inaugurated in the thoracic clinic by Mr. Allison. In that clinic all endoscopic work of the general hospital is carried out now. Mr. Allison teaches bronchoscopy to his interns. There is some cooperation with the ear, nose and throat department in that patients are sent there for examination of the upper air passages.

Bradford: Though a large center, it is not as yet a teaching center, nor is there a thoracic unit so far. Therefore, Mr. Donald Watson and Mr. Otty do all the endoscopic work, and patients are constantly being referred to them by the physicians.

Sheffield: Patients are still referred to the ear, nose and throat surgeon, Mr. J. H. Cobb, to have suspected foreign bodies removed from air and food passages, and on occasion a patient is referred by the physicians for report. The thoracic unit is beginning to take over all the other endoscopic work without any suggestion of cooperation.

Derby: Mr. R. L. Flett, who on several occasions has read papers on endoscopic work before the Royal Society of Medicine, writes that for more than three months he has not seen a single patient requiring endoscopic examination. All examinations are done by the thoracic surgeon without reference to him.

Manchester: The thoracic surgeon at the Manchester Royal Infirmary, Mr. Graham-Bryce, was trained in Chevalier Jackson's clinic in Paris and naturally carries out all the endoscopic work, including the removal of foreign bodies. Mr. W. F. Nicholson, thoracic surgeon attached to the other general hospital, was trained in the United States, and he also does the endoscopic work. Certain cases are still referred to Mr. G. E. Archer, the ear, nose and throat specialist. He thinks that, though in two Manchester units the thoracic surgeons are trained endoscopists, in other units the thoracic surgeons are carrying out the work when, generally speaking, they are not trained and are seeing patients who should be referred to the laryngologists.

Birmingham: Mr. Musgrave Woodman writes from Birmingham: "The position in Birmingham is that until the war I and my colleague did all the bronchoscopic examinations of our patients, and patients were referred by other physicians. In the Queen Elizabeth Hospital, Mr. Brian Taylor became interested in thoracic work and pushed very hard to do his own bronchoscopies. We compromised by following the lead of Liverpool and arranged that one of my laryngologic colleagues and Mr. Brian Taylor should carry out the examinations jointly. This has rather faded out, and at the present time Mr. Taylor carries out nearly all the bronchoscopic work without consulting the throat department. I am strongly of the opinion that a laryngologist should be attached to the thoracic unit and that the bronchoscopic examination should be a joint one, for the sake of both. Naturally I continue to do all the esophageal work." That is a rather definite example of bronchoscopy being divorced from esophagoscopy.

Nottingham: The position has changed since the war. Before 1939, Mr. E. J. G. Glass did all the endoscopic work, and the thoracic surgeon handed over the whole of the work to him. Unfortunately, the thoracic surgeon was killed during the war, with the resultant change of position. In the General Hospital the patients requiring bronchoscopy are admitted under a physician and referred to the otolaryngologist for examination. A special morning is devoted to this work. In

the City Hospital the position is different. All endscopic work is done by the thoracic unit but patients are referred for an opinion on the nose and throat. This is really worse than it appears on the surface, because any patients referred from the General Hospital with complete endoscopic notes have the examination, not infrequently, repeated by the thoracic team, though possibly nothing more is elicited.

Cardiff: Mr. R. D. Owen reports that in Cardiff Royal Infirmary all patients requiring endoscopic examinations are examined in his department; the same applies to the patients in Llandough Hospital, which is the big municipal hospital. In the Sully Hospital, where the thoracic unit is centered, bronchoscopic examinations are done by the thoracic surgeon. However, the majority of the patients are examined by the laryngologist and referred to the thoracic surgeon for operation. To quote Mr. Owen's letter: "We in this part insist as far as possible that the ordinary outpatient departments remain the main sieve for all these patients. This is important, both from the point of view of teaching and from that of preventing departments like the thoracic department from becoming a 'closed shop'."

Bristol: Mr. Angel James reports that all the work is being done by the thoracic surgeon, patients being referred directly to that unit by the physicians without reference to the upper air passages. There is no actual teaching of endoscopy.

Liverpool: The members of the thoracic unit do all their own bronchoscopic work. Foreign bodies are still removed by the ear, nose and throat department, with an occasional bronschoscopic and esophagoscopic examination. Possibly Mr. H. V. Forster does one a week.

The position in London is rather indefinite. The original work was done by Mr. V. E. Negus, who built up the clinic in King's College, which was responsible for teaching bronchoscopy to laryngologists. A foreign body clinic was established by the London County Council under Mr. Cawthorne, but this was, unfortunately, interrupted by the war.

In the city of London the laryngologists, as a general rule, were not interested in bronchoscopy. For a time the largest bronchoscopic clinic was sponsored by two physicians, Pinchin and Morlock. The influence of the late Mr. Tudor-Edwards, Britain's foremost thoracic surgeon, was responsible for thoracic surgeons of the area taking over a great part of the bronchoscopic work. He believed that all bronchoscopies should be done by the thoracic surgeon. Consequently when thoracic units were instituted by the London County Council, the laryngologists were not invited to take any part, and bronchoscopy was simply considered an examination. There was no provision for any experimental investigation or research.

The Brompton and Westminster Hospital Clinic under Mr. F. C. Ormerod is well known. I repeat his letter:

The position between us and thoracic surgeons is a little involved, but as far as we are concerned at Brompton the distribution of the work depends largely on the physicians. When I first went to Brompton there were only two thoracic surgeons, and, of these, only Tudor-Edwards performed bronchoscopy; the other

learned how to do it in the course of time. For a long time I think most of the patients were sent to me by the physicians for diagnostic bronchoscopy, but when one of these patients was later referred by the physician to the thoracic surgeon for operation, the latter usually carried out a second bronchoscopy. The thoracic unit has gradually grown until now there are two surgeons, two assistant surgeons, two or more registrars and two resident surgical officers. Up to the war I was doing 6 to 10 bronchoscopies a week; now the average is 2 to 3. The physicians at Brompton never do bronchoscopic work themselves and still refer a number of patients for diagnostic bronchoscopy. With regard to the teaching, the thoracic surgeons have men in training and teach them the method of endoscopy. I have postgraduates attending my department and picking up what they consider the best from both departments. At the Royal National Throat, Nose and Ear Hospital we are running a five months' course for postgraduates, and we have set aside a good deal of time for the teaching of endoscopy. One cannot object to the thoracic surgeons doing their own bronchoscopic work any more than one could object to the genitourinary surgeons doing their own cystoscopic work, but I feel it will be wrong for us, as following a specialty, to hand over the responsibility for carrying out and for teaching bronchoscopy.

Mr. Negus reports:

In London thoracic surgeons are doing large numbers of bronchoscopic examinations and are removing foreign bodies. They also carry out esophagoscopic examinations, and this practice is increasing. Sometimes they ask me for help with esophagoscopy, but seldom with bronchoscopy. There are two physicians at the Chest Hospital who do bronchoscopic work. I think it is unfortunate that endoscopy is being monopolized in this way. Although I feel that the thoracic surgeon should examine the bronchi or the esophagus of a patient on whom he may operate, I think that in cases which are unlikely to require external operation, endoscopy should remain in the hands of the laryngologist. There are laryngologists in all the large towns, but not thoracic surgeons, and therefore it is highly important that they should be properly trained, particularly in the removal of foreign bodies. This training can be obtained only by constant practice in cases in which there is no foreign body, such as bronchial and pulmonary abscesses, bronchiectasis and the various esophageal diseases. We had all our inpatient work concentrated at Epsom during the war, but the presence of a large thoracic unit with over 200 beds has diverted much of our work. We are doing all the bronchoscopic and esophagoscopic work at King's College, but as most of the equipment is at Epsom it is a little difficult. There are 1 or 2 cases a week. Our thoracic surgeons have been good in asking us to examine the nose and sinuses of the patients but they have been disappointed in the results of our treatment of sinusitis in cases of bronchiectasis and other inflammatory conditions of the lung. Our relations with the thoracic surgeons have been perfectly cordial; nevertheless, I feel that there should be a determined effort to prevent endoscopic work from drifting too much into their hands.

In Scotland the bronchoscopic work in Glasgow and Edinburgh is still in the hands of the laryngologists working in conjunction with the thoracic surgeons. In Aberdeen and Dundee the laryngologists do all the endoscopic work for the main reason that in neither center is there a complete thoracic unit.

From these reports it would appear that in Great Britain the thoracic surgeon is established as his own bronchoscopist. The thoracic surgeon

has forsaken general surgery, he has set himself to obtain a knowledge of pulmonary pathology, he has made himself familiar with diseases of the chest from the medical standpoint and it is only right that he should see the inside of the lung by carrying out a bronchoscopic examination. Unfortunately, he is unaccustomed to working in the mouth, the pharynx and the larynx and therefore in all cases has carried out the bronchoscopic work with the patient under general anesthesia. Anesthetists have had to adapt themselves to this requirement. The Laryngological Section of the Royal Society of Medicine, at a joint meeting with the Anesthetic Section, were amazed to hear one anesthetist suggest that for any bronchoscopic examination the patient should be premedicated one hour beforehand with scopolamine and morphine, then given tribromoethanol solution rectally one-half hour beforehand, the throat sprayed with a 1 per cent solution of cocaine hydrochloride one quarter of an hour beforehand and hexobarbital soluble given, if necessary, during the operation. He assured the Sections that this would allow the surgeon one half to three quarters of an hour to examine the patient. Those of us who use local anesthesia were left practically speechless!

During the war most areas had a thorac unit—a unit which became self centered. This unit was often attached to a "chest hospital" or a sanatorium for patients with tuberculosis, where a laryngologist was not available. All endoscopic work was carried out by the thoracic surgeon, and only patients with obvious obstruction of the upper air passages were referred to a visiting laryngologist for report. As a result of want of cooperation, lobectomy has been carried out in cases in which there has been a sinus infection, with consequent complications.

In an interesting thesis presented to the Faculty of Political and Social Science of Columbia University, in fulfilment of the requirements for the degree of Doctor of Philosophy, George Rosen discussed this very subject. He considered that a situation might well arise in which the thoracic surgeon would do all the bronchoscopic work for diseases of the chest, to whom physicians would refer patients; and the laryngologist would be left with the work of removing foreign bodies from the air and food passages. He suggests that from an economic point of view it would not pay to train a specialist in an intricate and delicate procedure which he will utilize so infrequently.

So much for the practice of bronchoscopy, but what of the teaching?

The teacher of bronchoesophagology must of necessity have a thorough knowledge of the upper air passages and the larynx, he must know the pathology, anatomy and physiology of the lung, he must have a knowledge of the anatomy and the pathology of the esophagus to below the diaphragm and he must have a working knowledge of abdominal surgery. It would seem that this is beyond the scope of the otolaryngologist,

however keen. But can the thoracic surgeon, who must also be a cardiologist, hope to fulfil this arduous task, which must include a complete training in laryngology?

In Britain the pendulum is swinging away from the laryngologist. Bronchoscopy, which introduced the science of bronchoesophagology, is slipping back into a mere examination. To many it has never been more than this, but the few who have made it a life's interest are looking for guidance from those who nutured it in the United States of America. Centralization seems to me the only remedy, the bronchoesophagologist forsaking otology and working side by side with the thoracic surgeon.

As I see it, the early laryngologists of Great Britain were unprepared for the birth of bronchoscopy and its development into bronchoesophagology.

Before the days of Killian there was little experimental work done on the bronchus and the esophagus. After Killian only a few took up the work seriously, considering it simply a further form of examination. The British hospital system did not allow of centralization. The science of bronchoesophagology has never been on a financial basis. In Great Britain the members of the medical profession have never favored excessive narrowness of specialization. The thoracic surgeon rightly wishes to carry out his own bronchoscopic examination of the lung in cases in which he is going to operate. As a consequence, bronchoscopy is falling into his hands, and the idealism of the specialty of bronchoesophagology is sinking into the depths of the chest.

EVALUATION OF FUNGOUS DISEASE OF THE EXTERNAL AUDITORY CANAL

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ALTHOUGH medical mycology preceded bacteriology by many years, there remains considerable misunderstanding concerning fungi and their relationship to man. This is particularly true about fungous disease of the external auditory canal. In the past decade considerable effort has been devoted to clarifying many of the aspects of this disease, but much work remains to be done.

HISTORICAL REVIEW

Mycetes have been studied for nearly three hundred years. In 1677 Hooke, with the aid of a magnifying lens, first discovered that the yellow spots on roses were living organisms. Micheli classified aspergilli as a genus of molds in 1729. In 1839 Langenbeck discovered that thrush was caused by a fungus. In the same year Schoenlein described the fungus causing favus. During the next thirty years the study of mycology flourished with the work on tinea circinata by Gruby in 1842, tinea versicolor by Eichstedt in 1846 and tinea pedis by Fox in 1870. Then for forty years mycology was overshadowed by the great work of Pasteur and his contemporaries in bacteriology. In 1910 Sabouraud published his "Les Teignes," which reestablished a sound approach to the neglected field of mycology. Further stimulation was received from Castellani, writing on tropical mycoses, and Jadassohn and Bloch investigating immunologic aspects of fungous diseases. Dermatophytosis was investigated by Miescher, Bruhns and Alexander, and sporotrichosis by de Beurmann. More recently excellent contributions have been made by Dodge, Shaw, Conant and others.

CLASSIFICATION AND CHARACTERISTICS

The classification of fungi has not, as yet, been completely or accurately worked out. They are members of the plant kingdom under the phylum Thallophyta. They do not contain chlorophyll, nor do they have

From the Pack medical group.
Presented as a candidate's thesis to the American Laryngological, Rhinological, and Otological Society in 1946.

the power of photosynthesis. The group Fungaceae contains the true fungi, bacteria and myxomycetes. Hyphomycetes, or fungi imperfecti, are included under true fungi and most of the fungi pathogenic to man belong in this group.

Fungi of different genera vary in structure and even fungi of the same genus may be altered by a change of medium and by the presence of bacteria. For practical purposes the base, the stalk and the head present the general picture of most fungi. More detailed analysis of the various myctes is contained in the works on mycology.

The physiology and the structure of the fungus permit it to be widely distributed, yet it is more capricious in its behavior than the bacterium. It thrives at room or body temperature. Increased moisture and humidity enhance its growth. Light inhibits its growth somewhat. All species, except Actinomyces bovis, require oxygen. Their nutrition consists of calcium, iron, potassium, sodium, carbon, nitrogen and phosphorus, sugars and occasionally fats and proteins. Their most favorable p_H is 5.6, but they tolerate a p_H of 5 to 7. Those responsible for superficial infections, the dermatophytes, live in the stratum corneum in relation to keratin and cannot survive in the deeper organs of the body.

Identification of a fungus is most expediently accomplished by direct microscopic examination. More elaborate technics are necessary to identify the species. Cultural methods employing giant colonies and cultural mounts, cutaneous tests, filtered ultraviolet ray examinations, animal inoculation, agglutination reactions, fermentation of sugars, complement fixation tests, autoinoculation, therapeutic tests and histologic examination assist in further identification as to species and pathogenicity. In the examination of cultural colonies attention should be given to color, texture, margins and surface and to rapidity, luxuriance and submergence of the growth. The different mediums suitable for culture are Sabouraud's, Fairchild's, dextrose agar, dextrose broth, conservation agar, cornmeal agar, potato-carrot agar, wort agar and anaerobic medium.

Lewis and Hopper[1] have listed the fungi according to their pathogenic propensities. It is here that a marked difference of opinion exists as to the etiologic factors involved in so-called fungous disease of the ear. The vast majority of fungi reported by otologists as causing disease of the ear have been classified as common contaminants. Lewis recommended skepticism regarding claims of pathogenicity of fungi of ordinarily nonpathogenic species until more proof of their pathogenicity than the mere fact that they occur in the diseased tissue is offered. Simple

1. Lewis, G. M., and Hopper, M. E.: An Introduction to Medical Mycology, Chicago, The Year Book Publishers, Inc., 1943, pp. 160-161.

repeated isolation is not adequate. It is desirable that they be reinoculated in healthy tissue and in animals.

According to Lewis and Hopper, the following fungi are pathogenic:

1. Microsporum
   - Microsporum audouini
   - Microsporum lanosum
   - Microsporum fulvum
   - Microsporum ferrugineum
2. Achorion schoenleini
3. Trichophyton
   - Trichophyton violaceum
   - Trichophyton crateriforme
   - Trichophyton sulfureum
   - Trichophyton gypseum
   - Trichophyton purpureum
4. Epidermophyton inguinale
5. Monilia albicans
6. Malassezia furfur
7. Actinomyces minutissimus, bovis
8. Endodermophyton tropicale
9. Hormodendrum pedrosoi
10. Phialophora verrucosa
11. Sporotrichum schenckii
12. Blastomyces dermatitidis
13. Histoplasma capsulatum
14. Paracoccidioidies brasiliensis
15. Torula histolytica
16. Rhinosporidium seeberi
17. Coccidioides immitis

(There are seven additional pathogenic fungi in other sections of the world.)

Probably pathogenic:

1. Actinomyces tenius
2. Aspergillus fumigatus
3. Hormodendrum compactum
4. Pityrosporum ovale

Questionably pathogenic:

1. Some facultative saprophytes

Common contaminants:

1. Aspergilli glaucus, fumigatus, niger, nidulans, flavus and candidus
2. Penicillium
3. Mucor
4. Alternaria (macrosporium)
5. Hormodendrum
6. Fusarium
7. Scopulariopsis
8. Dematium
9. Mycoderma
10. Torula (cryptococcus)
11. Chaetomium

LITERATURE

Otomycosis has been described as a specific entity for many years, yet its incidence and significance are still unsettled. Mayer described it in 1844, Pacini in 1864, and Schwartz in 1856, as cited by Werden.[2] The early writers considered it a rare condition. They used medicaments that have recently been shown to have little or no fungicidal power. These authors limited their description to the genus Aspergillus. A later group of authors placed great emphasis on the prevalence and the chronicity of this type of infection. They added considerably to the number and the kinds of medicaments already in use. Since 1932 more effective fungicides have been employed, and considerable progress has been made in understanding fungous infections of the external canal.

A recent group of writers discovered that what had been diagnosed consistently as fungous disease was predominantly a bacterial infection of the skin of the canal and that otomycosis was relatively rare. They failed to isolate the ubiquitous fungus from normal ears and stated that the typical clinical signs and symptoms of fungous disease were also typical of some bacterial infections of the aural canal. They emphasized that many of the reports of otomycosis were presumptuous and that there was considerable doubt about the pathogenicity of fungi generally classified as saprophytic and nonpathogenic.

In the light of such conflicting opinions the literature on the subject was reviewed. A survey of most of the textbooks discussing otomycosis since 1899 emphasized the inadequate and repetitious information pertaining to the subject. The early writers considered this condition to be resistant, and a vast number of therapeutic agents appeared. Many undoubtedly were used as fungicides where no fungi existed. Buck[3] in 1899 stated that aspergilli infected the external auditory canal and recommended cleansing the canal and then applying a silver nitrate solution, followed by antiseptic powders, topically, as the form of treatment. Burnett, Ingals and Newcomb[4] described A. niger and A. glaucus infection of the skin over the bony canal wall and the drum. Their treatment was to syringe the canal with an alkaline solution, dry the skin and apply antiseptic powder. In 1902 Politzer[5] recognized A. niger and A. flavus

2. Werden, R.: Sechs Fälle von Myringokosis, Arch. f. Ohrenh. **3**:1-21, 1867.

3. Buck, A. H.: First Principles of Otology, New York, W. Wood & Co., 1899, p. 31.

4. Burnett, C. H.; Ingals, E. F., and Newcomb, J. E.: A Text Book on Diseases of the Ear, Nose and Throat, Philadelphia, J. B. Lippincott Company, 1901, pp. 101-103.

5. Politzer, A.: A Text-Book of the Diseases of the Ear for Students and Practitioners, translated by M. J. Bollin and C. L. Heller, Philadelphia, Lea Brothers & Co., 1902, pp. 181-185.

as etiologic agents and related that excellent results had followed cleansing the canal and then instilling alcohol. The same year Grayson[6] suggested that 1:2,000 mercury bichloride solution or 2 per cent salicylic acid in alcohol be tried in addition to the other forms of therapy already in use. Bacon[7] and Barr[8] described Aspergillus as infecting the skin over the bony canal wall and the drum. In regard to treatment, they advocated the use of potassium permanganate, salicylic acid and alcoholic solutions. Ballenger[9] in 1909 listed A. niger, A. flavus and A. fumigatus as infecting the bony canal wall and described alcohol as "the remedy par excellence." He noted that the disease had a tendency to recur. Reik[10] advocated cleansing, then using alcohol, followed by zinc oxide and boric acid powders, against A. niger and A. flavus infections. Kerrison[11] localized the A. niger and A. flavus infection on the inner bony canal wall and the drum. Cleansing, instillation of alcohol, and application of 1 per cent phenol and 2 per cent salicylic acid in alcohol were the procedures used in treatment.

Little change occurred in the attitude toward otomycosis during the next thirty years. Jackson and Coates[12] classified the condition as rare and resistant to treatment. Cleansing, application of 10 per cent salicylic acid in alcohol and treatment with ultraviolet rays from the quartz mercury vapor arc lamp were recommended. Turner[13] cited A. niger as the infecting agent. He advocated removing the mass of "soft, discolored, wet paper exudate" and instilling alcohol. Cleaning by irrigating with boric acid, drying and then applying 2 per cent salicylic acid in alcohol comprised the treatment recommended by Brown[14] in 1939. Lederer[15]

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6. Grayson, C. P.: The Diseases of the Nose, Throat and Ear, Philadelphia, Lea Brothers & Co., 1902, pp. 367-370.

7. Bacon, G.: A Manual of Otology, Philadelphia, Lea & Febiger, 1909, p. 135.

8. Barr, T.: Manual of Diseases of the Ear, Glasgow, J. Maclehose & Sons, 1909.

9. Ballenger, W. L.: Diseases of the Nose, Throat and Ear, Medical and Surgical, Philadelphia, Lea & Febiger, 1909, pp. 655-656.

10. Reik, H. O.: Diseases of the Ear, Nose and Throat, New York, D. Appleton and Company, 1911, pp. 67-68.

11. Kerrison, P. D.: Diseases of the Ear, Philadelphia, J. B. Lippincott Company, 1913, pp. 116-118.

12. Jackson, C., and Coates, G. M.: The Nose, Throat and Ear and Their Diseases, Philadelphia, W. B. Saunders Company, 1929, p. 466.

13. Turner, A. L., and others: Diseases of the Nose, Throat and Ear, ed. 4, Baltimore, Williams & Wilkins Company, 1936, p. 318.

14. Brown, L. C.: Inflammation of the External Ear and External Auditory Meatus, in Fowler, E. P., Jr.: Medicine of the Ear, New York, Thos. Nelson & Sons, 1939, pp. 127-136.

15. Lederer, F. L., and Hollender, A. R.: Textbook of the Ear, Nose and Throat, ed. 4, Philadelphia, F. A. Davis Company, 1943, pp. 113-114.

mentioned meta-cresylacetate ("cresatin") and thymol, alkaline irrigation, 95 per cent alcohol, 1 per cent salicylic acid in alcohol, 10 to 25 per cent silver nitrate, aluminum acetate, tincture of iodine, methylrosaniline chloride U.S.P. (gentian violet) and methylene blue U.S.P.

Gill[16] covered the subject comprehensively. He divided fungous disease into three types, that due to the budding type of fungi, that due to the filamentous type and that due to higher bacterial forms. The budding type of fungi comprised Saccharomyces, Torula, Monilia, Oidium and Coccidioides; the filamentous type, Aspergillus, Penicillium and Mucor; the higher bacterial, Actinomyces. Cleansing, applying meta-cresylacetate, thymol in alcohol and antiseptic powders locally and giving iodides internally were recommended. Here Pseudomonas aeruginosa was also mentioned as an added infective factor, and acetic acid, meta-cresylacetate and aluminum acetate were suggested for treatment. The using of an alcoholic solution as ear drops after swimming was advised. Hollender[17] advocated the use of meta-cresylacetate and thymol in alcohol.

Mycologists, in writing textbooks, originally presented otomycosis as the early otorhinolaryngologists did. However, the authors of more recent publications have different opinions. Castellani[18] stated that fungous disease of the ear is comparatively frequent and that Aspergillus is the chief causative agent. Jacobson[19] proposed that A. niger and A. fumigatus be considered as pathogenic and as contributing to the initiation and prolongation of the disease of the external auditory canal. Sutton and Sutton[20] listed A. fumigatus and A. niger, Monilia, Sporothrix, Blastomyces, Actinomyces, Coccidioides, Torula, Achorion and Penicillium as causing external disease of the ear. A thick gray, blotting paper type of exudate was described as characteristic. They believed it might serve as a focus for dermatophytic reactions. It did not resolve spontaneously and was best treated by cleansing and drying, then using a meta-cresylacetate pack, followed by 1 per cent thymol in 70 per cent alcohol.

Lewis and Hopper[1] were skeptical about the whole subject of otomycosis, believing it was diagnosed too often with inadequate and inaccu-

16. Gill, W. D.: Otomycosis, in Jackson, C., and Jackson, C. L.: Diseases of the Nose, Throat, and Ear, Philadelphia, W. B. Saunders Company, 1945, pp. 243-247.

17. Hollender, A. R.: Office Treatment of the Nose, Throat and Ear, ed. 2, Chicago, The Year Book Publishers, Inc., 1946, p. 404.

18. Castellani, A.: Fungi and Fungous Diseases, Arch. Dermat. & Syph. **17**: 135 (Jan.) 1928.

19. Jacobson, H. P.: Fungous Diseases, Springfield, Ill., Charles C Thomas, Publisher, 1932.

20. Sutton, R. L., and Sutton, R. L., Jr.: Diseases of the Skin, ed. 10, St. Louis, C. V. Mosby Company, 1939, pp. 1111-1112.

rate laboratory study. Autoinoculation with Aspergillus in their experiments was unsuccessful. They have never isolated fungi of pathogenic titer from the aural canal, yet stated that perhaps under the special environmental conditions existing in the canal special pathogenic propensities may be established. They recommended cleansing the canal, then applying 1 per cent aqueous solution of medicinal gentian violet or 1 per cent thymol in alcohol topically, and radiation therapy. In the "Manual of Clinical Mycology"[21] A. fumigatus is considered as a cause of otomycosis in man. Aspergillosis of the eyes, the sinuses and the lungs affirms the pathogenicity of Aspergillus. A thermolabile hemolytic endotoxin has been extracted from A. fumigatus, but the antibody response in human subjects is not known. This text, however, reemphasizes that it is difficult to evaluate otomycosis, because of the inadequacy of reports and the uncertainty as to whether fungi that are ordinarily classified as contaminants should be reported as pathogens. It is believed that too little attention has been paid to the pathogenic bacteria present in the exudate along with the fungus. Most likely the fungus contributes to the condition by maintaining the infection and some of the symptoms.

Thom and Raper,[22] in an extensive manual on Aspergillus, described the activities and uses of this important genus of molds. Aspergilli contain intracellular enzymes capable of producing organic acids, antibiotic substances, toxins, sugars, alcohols, vitamins, various pigments and coloring substances, and bactericidal substances. Bacteria alter the characteristics of the Aspergilli, but the latter are capable of living in symbiosis with pathogenic and nonpathogenic organisms. Penicillium may grow parasitically on A. niger.

The external canal of the ear fulfils many of the requirements for fungous growth, and the opinion has been advanced by many writers that fungi are common inhabiters of the ear. Dart[23] considered otomycosis common and the ubiquitous saprophytes as pathogenic. Itching, aching, discharge, blotting paper type exudate, sense of fulness and diminished hearing were the usual signs and symptoms. Fungi were isolated from 20 infected ears, yet the ears of another group of 30 persons with similar symptoms failed to reveal fungi. Silver picrate (silver trinitrophenolate) was not effective as used in therapy. Meta-cresylacetate and 1 per cent thymol in alcohol were effective. Minchew, Collins

21. Conant, N. F., and others: Manual of Clinical Mycology, Military Medical Manual, National Research Council, Division of Medical Sciences, Philadelphia, W. B. Saunders Company, 1944, chap. 12 and 22, pp. 191-197 and 279-282.

22. Thom, C., and Raper, K. B.: A Manual of the Aspergilli, Baltimore, Williams & Wilkins Company, 1945.

23. Dart, M. O.: Otomycosis: Treatment with Silver Picrate, Arch. Otolaryng. **31**:885-910 (June) 1940.

and Harris[24] studied 93 cases, in 30 per cent of which they demonstrated fungi, aspergilli predominating. Only 3 per cent of cultures of material taken from normal ears and skin revealed fungi. They found the bacterial flora of infected and noninfected ears essentially the same.

Senturia[25] stated that fungi, particularly spores, were frequent inhabiters of the canals of the ears. These mycetes were capable of flourishing on cerumen and produced a toxin that altered the protective barrier of the skin and permitted sceondary bacterial invasion. Senturia and Wolf[26] experimented with fungi and the sulfonamide compounds. Sulfanilamide was fungistatic for Aspergillius, Penicillium and Mucor. Monilia was not affected.

Davis[27] cultured what he believed to be a trichophyton in 11 of 16 cases of external disease of the ear. He found it growing in the wax most frequently. Palmer[28] studied "hot weather ear" in India, found it to be common, believed it to be a "ringworm infection" but was unsuccessful in demonstrating any mycotic elements. Johnston[29] stated that external disease of the ear accounted for a third of all aural conditions in the South and that otomycosis was common. He emphasized the bactericidal qualities of cerumen and said that it would kill staphylococci and streptococci in a few days. He did not believe that sulfonamide compounds were fungicidal. The saprophytes were classifed as pathogenic to man, and the condition was best treated with 2 per cent thymol in meta-cresylacetate. Pittenger[30] reported 13 cases of aspergillosis of the external auditory canal, describing the "blotting paper" type of exudate, containing black dots, present in the canal. The condition was not uncommon, and salicylic acid in alcohol gave excellent results. Sasaki[31] found otomycosis in 2.1 per cent of all patients with aural disease in Japan. It was located usually in the inner canal wall and the drum,

24. Minchew, B. H.; Collins, B. E., and Harris, M. M.: External Ear Disease with Special Reference to Fungous Type, South. M. J. **33**:1345-1348 (Dec.) 1940.

25. Senturia, B. H.: Treatment of External Otitis: I. Local Sulfonamide Therapy, Laryngoscope **54**:277-287 (June) 1944.

26. Senturia, B. H., and Wolf, F. T.: Treatment of External Otitis, Arch. Otolaryng. **41**:61-63 (Jan.) 1945.

27. Davis, E. L.: Mycotic Infections at Advanced Allied Base, M. J. Australia **2**:437-438 (Nov. 27) 1943.

28. Palmer, F. J.: Hot Weather Ear—A Clinical Entity, Indian M. Gaz. **69**:430-432 (Aug.) 1934.

29. Johnston, W. H.: Otitis Externa, Ann. Otol., Rhin. & Laryng. **53**:5-14 (March) 1944.

30. Pittenger, B. N.: Case Reports of Aural Aspergillosis, Kentucky M. J. **36**:161-162 (April) 1938.

31. Sasaki, H.: Ueber die Otomycosis, besonders ihre Pilzaten, mit Ausnahme der Aspergillusarten, Fukuoka acta med. (Abstr. Sect.) **32**:97-98 (Oct.) 1939.

also in the wax. There were no spontaneous remissions, but 2 per cent salicylic acid in alcohol cured the condition. Terasi[32] calculated a lower incidence of fungous infection and stated that aspergilli could survive in cerumen for one year without any other type of nourishment. Philpott and Chessen,[33] in their paper on tropical otitis, failed to establish a definite etiologic agent. However, they stressed leaving wax in the aural canal and removing it only to relieve pain or deafness. Reeh[34] reported on 215 cases of otomycosis in the Panama Canal Zone. Various clinical manifestations of the disease were described. The wet, macerated, blotting paper type of exudate was typical. Aspergilli were usually found. Alcohol and salicylic acid in alcohol were ineffectual. Application of 1 per cent thymol in meta-cresylacetate gave excellent results. The specific fungi which were isolated and the manner of identification were not specified.

Dobes[35] reported on a case of Monilia albicans infection of the external auditory canal. He cited the failure of Benham and Hopkins to find this fungus on cultures of 100 normal skins.

Shea[36] expressed the belief that fungous infections are more common than has been reported. He isolated A. niger from 2, Nocardia from 2 and Oidium from 2 of 6 middle ears requiring surgical treatment. Staphylococci and Bacillus proteus were also present in some of the cultures.

Whalen[37] stated that fungous infection of the aural canal was a common condition. He mentioned that certain fungi, including Aspergillus, Monilia and Achorion, were associated with marked dermatitis of the canal. Animals inoculated with these mycetes showed infection; fungicides cured the conditions that developed and antibacterial treatment did not effect improvement. This was considered adequate proof of pathogenicity. Treatment consisted in cleansing the canal, applying 1 per cent thymol in alcohol, followed by thymol iodide (powder) locally, and administering 30 grains (1.94 Gm.) of potassium iodide daily for thirty days.

In 1927 Myers[38] proposed that thymol be used in the treatment of molds. K. Gill[39] called attention to the value of meta-cresylacetate.

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32. Terasi, T.: Studien über die Otomycosis, insbesondere "Otomycosis aspergillina," Fukuoka acta med. (Abstr. Sect.) **32**:87-88 (Sept.) 1939.

33. Philpott, I. W., and Chessen, J.: Tropical Otitis, Rocky Mountain M. J. **42**:345-347 (May) 1945.

34. Reeh, M. J.: Treatment of Otomycosis, Ann. Otol., Rhin. & Laryng. **51**:146-152 (March) 1942.

35. Dobes, W. L.: Moniliasis of External Ear Canal, South. M. J. **36**:614-616 (Sept.) 1943.

36. Shea, J. J.: Mycosis of Middle Ear and Mastoid, Laryngoscope **52**: 784-789 (Oct.) 1942.

37. Whalen, E. J.: Fungous Infections of External Ear, J. A. M. A. **111**:502-504 (Aug. 6) 1938.

38. Myers, H. B.: Unappreciated Fungicidal Action of Certain Volatile Oils, J. A. M. A. **89**:1834-1836 (Nov. 26) 1927.

McBurney and Searcy[40] experimented with sixty-nine substances that had been used as fungicides and thus contributed significantly to the logical treatment of otomycosis. Many of these drugs, especially alcohol and salicylic acid in alcohol, had practically no effect on Aspergillus. Two per cent thymol in alcohol combined with meta-cresylacetate or "merthiolate" (sodium ethylmercurithiosalicylate) (1:1,000), and thymol-boric acid-iodine mixture yielded the best results in some 150 cases of otomycosis. Their work warrants personal review.

W. D. Gill[41] elaborated on the treatment and stated that otomycosis was common. He suggested there may be hypersensitivity to the toxins of the fungi in the external canal. He suggested 2 per cent acetic acid when Bacillus pyocyaneus co-infected the skin. In therapy the essential points were control of pain, control of mycotic infection and prevention of reinfection. Later Gill[42] stated that the sulfonamide compounds were not impressive when used against molds.

Odom, Rodenberg and Schain[43] reported a case of Actinomyces infection of the external canal. There was suppuration in the middle ear also, and the smear for bacteria revealed gram-positive cocci and bacilli. They found the mycetes very resistant to 10 per cent thymol applied topically and also to irradiation. It required four days of constant contact with 10 per cent thymol to render the culture sterile. Cann and Hollis[44] found Actinomyces in the middle ear of a patient who died of Actinomyces infection of the meninges. Other authors have related similar cases. Walker[45] found some local success on using sulfanilamide powder against Actinomyces.

Many authors have not agreed that otomycosis is a common disease. These writers have isolated pathogenic bacteria, chiefly Ps. aeruginosa, from the infected external auditory canals.

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39. Gill, K.: Otitis Externa Mycotica, Arch. Otolaryng. **16**:76-82 (July) 1932.

40. McBurney, R., and Searcy, H. B.: Otomycosis: Investigation of Effective Fungicidal Agents in Treatment, Ann. Otol., Rhin. & Laryng. **45**:988-1008 (Dec.) 1936.

41. Gill, W. D.: Otomycosis: Some Remarks Concerning Its Prevalence, Symptomatology and Treatment, Ann. Otol., Rhin. & Laryng. **47**:189-196 (March) 1938.

42. Gill, W. D.: Otitis Externa, Ann. Otol., Rhin. & Laryng. **51**:370-377 (June) 1942.

43. Odom, S. G.; Rodenberg, E. J., and Schain, P.: Streptomyces (Actinomyces) Albus in the Ear, Arch. Otolaryng. **39**:137-143 (Feb.) 1944.

44. Cann, L. W., and Hollis, G. J.: Case of Actinomycotic Cerebro-Spinal Meningitis Associated with Aural Actinomycosis, Lancet **1**:130-131 (Jan. 17) 1931.

45. Walker, O.: Sulphanilamide in Treatment of Actinomycosis, Lancet **1**:1219-1220 (May 28) 1938.

Dunlap[46] failed to find any fungus in a study of so-called "Hong Kong ear" or "fungus ear" in China, but did culture B. pyocyaneus frequently. Greaves[47] studied 75 cases of external otitis by smear, hanging drop and culture and failed to discover any fungi.

Daggett[48] emphasized the rarity of fungi in a review of 49 cases of desquamative external otitis occurring in Malta. He found Staphylococcus albus in 90 per cent of the normal ears and B. proteus and B. pyocyaneus frequently in the infected ones.

Raiford[49] believed that external otitis due to infection was usually the result of local trauma and Staphylococcus aureus invasion. His patients responded well to penicillin therapy. Mitchell[50] also expressed the belief that fungous infection of the canal was rare. He frequently isolated streptococci from retroauricular lesions presenting fissures, scales and weeping surfaces.

Quayle[51] made cultures of material from 200 unselected normal ears in the tropics and found fungous growth in only 5 per cent. He also cultured material from 25 consecutive ears showing "desquamative otitis externa" that resembled fungous disease clinically, and only 4 yielded any fungus. Ps. aeruginosa was a common offender. He noted that in New Guinea the natives, with their larger, straighter canals without cerumen, rarely suffered from external diseases of the canal. The Australian troops without wax were more prone to such diseases.

Beach and Hamilton[52] studied 69 cases of external otitis occurring in the Solomon Islands. In 65 the ears were infected by Ps. aeruginosa; in 1, by fungus, and in 3, by mixed diphtheroids, streptococci and staphylococci. Of 50 normal ears studied, none contained Ps. aeruginosa. An analysis of the river water in the area showed it to be abundantly polluted with this organism. Ocean water up to a distance of 200 yards (183 meters) from the mouth of a river was also polluted. Well water did not contain the organism. They were of the opinion that contamination of the aural canal with this polluted water was a contributory factor.

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46. Dunlap, A. M.: Otomycosis, Chinese M. J. **52**:446 (Sept.) 1937.

47. Greaves, F. C.: Phenyl Mercurio Nitrate in Treatment of Otitis Externa and of Dermatophytoses, U. S. Nav. M. Bull. **34**:527-532 (Oct.) 1936.

48. Daggett, W. I.: Desquamative Otitis Externa in Malta, J. Laryng. & Otol. **57**:427-446 (Oct.) 1942.

49. Raiford, M. B.: Penicillin Therapy in Otitis Externa, Virginia M. Monthly **72**:258-260 (June) 1945.

50. Mitchell, J. H.: Streptococcic Dermatoses of Ears, J. A. M. A. **108**: 361-366 (Jan. 30) 1937.

51. Quayle, A. F.: Otitis Externa in New Guinea, M. J. Australia **2**:228-231 (Sept. 2) 1944.

52. Beach, E. W., and Hamilton, L. L.: Tropical Otitis Externa, U. S. Nav. M. Bull. **44**:599-601 (March) 1945.

Syverton[53] studied 72 infected ears in Guam and isolated fungi from 18 of them. These fungi and their percental rates of incidence were Actinomyces, 11; Aspergillus, 11; Monilia tropicalis, 3; Phytomonas, 3. Six fungi were coincident with Ps. aeruginosa. Actinomyces and Aspergillus, and Aspergillus and Monilia were recovered from ears not containing any pathogenic bacterial. Two thirds of all the ears studied contained Ps. aeruginosa. After making cultures of material obtained from 16 normal ears, they concluded that Staph. albus and Staph. aureaus, Micrococcus, sarcinae and diphtheroids were normal inhabitants. Fungi were not found in normal ears. Tortuosity, diameter and length of the canal were not factors. They concluded that the role played by fungi in infections of the external canal had been greatly exaggerated and that more emphasis should be given pathogenic bacteria, particularly Ps. aeruginosa.

CERUMEN

There has been considerable discussion about the part cerumen plays in infections of the external canal. Some investigators have declared it to be bactericidal and protective. Others have noted that fungi and bacteria will grow directly on or in the wax.

Creed and Negus[54] showed that wax had no bactericidal action. They estimated the number of ceruminous glands in the canal to be 1,000 to 2,000. They found that the wax was composed of water, free fatty acids, fats, cholesterol, soluble acids, urea and other water-soluble and water-insoluble substances. The percentage of total nitrogen in cerumen dried in vacuo was 6.21, ash 7.08, total insoluble fatty acids 19.84 and lecithin 3.74. The base in man, ox, sheep and pig was potassium, in dog calcium and in horse magnesium. The pigment was strongly analogous to human fats, but unlike the latter it was only slightly soluble in ether. However, it was very soluble in alcohol, fats and alkaline solutions. Its odor was bitter, and it contained leukomaines. They also reported that its color and consistency were not affected by age or width of the canal. Males, in general, had ample quantities of the darker, harder cerumen and females the scanty, soft, lighter variety. Increased sweating appeared to increase the amount of cerumen.

In an analysis of the data collected in 47 cases Creed and Negus found that only in 8 did smear fail to reveal bacteria and only in 2 did culture fail to do so. The fresh, light, soft wax contained fewer bacteria than the dark, hard wax. Staphylococci were present in 52 per cent, diphtheroids in 36 per cent, sarcinase in 33 per cent, Micrococcus

53. Syverton, J. T.: External Otitis, Arch. Otolaryng. **43**:213-226 (March) 1946.

54. Creed, E., and Negus, V. E.: Function of Aural Cerumen, J. Laryng. & Otol. **41**:223-231 (April) 1926.

tetragenus in 14 per cent, gram-negative diplococci in 12 per cent, streptococci and pneumococci in 0.5 per cent each. More bacteria were found in the membranous than in the bony portion of the canal.

Nakashima[55] analyzed cerumen and found potassium, sodium, calcium, magnesium, phosphorus, hydrogen, sulfur, chlorine and silicon among the inorganic substances, and histidine, arginine, lysine, tyrosine, cystine and proline among the amino acids. The percentages of its constituents were as follows: fatty acids, 0.85; fats, 12.37; cholesterol, 2.48; cerotinic acid, 1.94; neurostearic acid, 0.35; $C_8H_{14}NO_5$, 0.82; protein, 43.23; ash, 3.45.

Pirodda[56] studied the bactericidal power of the cerumen of 12 persons on different organisms. He discovered that there was significant bactericidal effect on pneumococci and diphtheria bacilli. Streptococci were affected slightly, and Staph. aureaus, Staph. albus and Ps. aeruginosa not at all. He did not know what this antibacterial substance was but suspected that it was associated with the hydrogen ion concentration.

Brann[57] also claimed bactericidal power for alcohol, ether and acetone extracts of cerumen. He did not identify the exact nature of the substance but found it to be present in extracts of skin and hair also.

Trimarchi[58] investigated cerumen for fungi and discovered that these were present in it frequently, even in persons who had no symptoms. The genus Aspergillus was found most often, and in this group A. niger perdominated. He stated that it was often responsible for the rapid reaccumulation of wax, yet it was capable of living on the surface or deep in the core of the cerumen without causing any disturbance. He also stated that wax had little bactericidal power and that the Koch bacillus had been found growing in it. Salicylic acid in alcohol gave excellent results in controlling the presence of fungi.

Miyake,[59] after studying 76 family lineages, found that persons with soft wax "follow the dominant heredity regardless of sex, after Mendel's law." Nakano[60] and Hirota and Miyake[61] established a definite relation-

55. Nakashima, S.: Ueber die chemische Zusammensetzung des Cerumens, Ztschr. f. physiol. Chem. **216**:105-109, 1933.

56. Pirodda, A.: Ha il cerume potere battericida (Contributo sperimentale), Oto-rino-laring. ital. **7**:171-182 (April) 1937.

57. Brann, G.: Untersuchungen über die Bactericide der Haut, der Haare und des Ohrenschmalzes, Klin. Wchnschr. **7**:2059-2060 (Oct. 21) 1928.

58. Trimarchi, A.: Sulla presenza di iformiceti nei comuni tappi di cerume, Osp. maggiore **17**:319-321 (Sept. 30) 1929.

59. Miyake, M.: On Hereditability of Soft Cerumen, Bull. Nav. M. A. Japan (Abstr. Sect.) **25**:40-41 (July 15) 1936.

60. Nakano, Y.: On Correlation Between Soft Cerumen and Osmidrosis from View Point of Conscriptional Medicine, Bull. Nav. M. A. Japan (Astr. Sect.) **25**:46-47 (Aug. 15) 1936.

ship between soft wax and osmidrosis. An analysis of data concerning almost 5,000 persons showed 86 per cent to have hard, dry wax and 14 per cent the soft, yellow wax. Ninety per cent of the group with soft wax had osmidrosis. Markert[62] found no essential difference in blood cholesterol between 10 persons with no cerumen and 10 with copious amounts of cerumen.

DISCUSSION OF CASES REPORTED

In an attempt to clarify some of the problems related to so-called "fungous disease of the ear," 32 cases of external otitis were carefully studied in the Philippine Islands. Our first concern was to decide whether this type of infection, which is prevalent in the tropics, actually was fungous infection. Patients presenting some of the classic clinical features of fungous infection were selected. This syndrome has been repeatedly described as characterized by itchiness, sense of fulness, blotting paper type of exudate and tendency toward chronicity. Many of the subjects had been considered as having, and were treated for, fungous disease of the ears for months and years.

The group was composed of 25 members of the United States Armed Forces. Their average age was 26.5 years. Some of them had been in the tropics for two and three years, and others had just arrived from the United States. Their duties varied from those of outside labor details to clerical work.

Cultures on Sabouraud's medium and wet and dry smears were used to identify fungi. The material was also studied for bacteria by smear and culture, and the character of debris by smear.

Itchiness, sense of fulness, pain, chronicity, blotting paper type of exudate and causative factors were evaluated. No cases of suppurative otitis media were included in this review.

The striking feature of the cultures was the prominence of Ps. aeruginosa. It was present in 22 instances—in 6 alone, in 15 as the pathogen and in 1 with other pathogens. Clinically and on culture it manifested great variety of color development. Black, brown, green, yellow and gray were noted, but gray was most common. It was the organism that could most easily be mistaken for a fungus.

Fungi occurred in only 5 cases. Mucor was present once and A. niger three times with Ps. aeruginosa. The presence of fungi under these circumstances significantly lessens their importance as true pathogens. However, A. niger also appeared once with diphtheroids.

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61. Hirota, S., and Miyake, S.: Clinico.-Statistical Observations of Osmidrosis and Soft Cerumen, Bull. Nav. M. A. Japan (Abstr. Sect.) **25**:69-70 (Oct. 15) 1936.

62. Markert, R.: Zur Aetiologie des residivierenden Cerumen obturans, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **124**:93-98 (Nov.) 1929.

B. proteus was present in 3 cases. In 7 instances organisms or combinations of organisms which are ordinarily considered nonpathogenic when present in the ear were cultured. In case 2 there had been 7 exacerbations in four hundred and eighty-two days of the disease. The tissues of the canal were congested and swollen, and the lumen contained a whitish, blotting paper type of exudate. The culture revealed only diphtheroids. In case 32 there had been 2 exacerbations in one thousand, four hundred and sixty days of the disease. There was an amorphous whitish accumulation, as well as slight purulent exudation, in the canal. Staph. albus was the only organism cultured.

Although staphylococci, diphtheroids, sarcinae and micrococci are found in normal aural canals, it is possible for them to act as etiologic agents in ears where infection may be precipitated by decrease of local resistance and trauma.

Twenty-one cultures showed more than one organism, usually one pathogenic and one common inhabitant of the canal. Fungi grew in the presence of pathogenic and nonpathogenic bacteria. (table).

Cultural Studies

Total	32
Pseudomonas aeruginosa	6
Ps. aeruginosa, Staphlyococcus aureus	5
Ps. aeruginosa, Micrococcus	4
Ps. aeruginosa, Aspergillus niger	3
Ps. aeruginosa, Staphylococcus albus	1
Ps. aeruginosa, hemolytic Staph. aureus	1
Ps. aeruginosa, Mucor	1
Ps. aeruginosa, Sarcina	1
Bacillus proteus (Proteus vulgaris)	2
B. proteus, diphtheroids	1
Staph. albus	2
Staph. albus and Staph. aureus	1
Staph. albus, diphtheroids	1
Staph. albus, Sarcina	1
Diphtheroids	1
As, Niger, diphtheroids	1

Itchiness was the most prominent early symptom and was noted in 22 cases. It varied in degree from mild to intense and uncontrollable. On occasion it was complained of when the examination showed the canal was normal. This type of otitis often reappeared with severe pain after the ear had been traumatized by scratching. Many ears showed redness, thickening and fulness of the outer canal wall. In the majority of the cases the canals were plugged with the macerated, blotting paper type of exudate. All the patients with fungi complained of itchiness to some degree. Seventeen patients with itchy canals responded by scratching or manipulating the canal wall with a finger or an implement of some type. Some described this desire as irresistible. This proved to be the precipitating cause of acute pain and swelling in most instances. Although itchiness was present in the subjects with fungi, it was also present in more than half of those without fungi. Ps. aeruginosa infections were frequently preceded by itchiness, and this organism was present in 4 of the 5 cases in which the ears were shown to contain fungi.

It may also occur in canals that appear normal and canals that have recovered from painful bacterial infections.

Pain was the symptom that brought the patient to the doctor in most instances. It indicated acute pyogenic infection of the subepithelial layers, chiefly in the region of the membranous canal wall. It was associated with edema and injection of the capillaries of the external canal, changes which caused marked narrowing of the lumen. Less frequently there was injection of vessels and edema of the inner canal wall. There was never abscess formation, the process being limited to acute cellulitis with concomitant lymphadenitis involving particularly the preauricular and subauricular glands. It was difficult to examine 15 patients, because of this acute swelling of the membranous canal wall. Twenty-two subjects eventually suffered with pain. Over half of the persons who experienced itchiness at the onset eventually had pain. In 10 pain developed as the first symptom. The severity of this complaint was marked and often required an analgesic and sedative. The pain was localized in the ear or immediately about the canal. Occasionally it was associated with temporal headache. Energetic manipulation of the external canal exaggerated the process and the pain, and often precipitated pain and infection where only itchiness had been present. This discomfort lasted two to five days and usually subsided within forty-eight hours after treatment was begun.

The chronicity of this disease was striking, especially under the environmental circumstances in which it was studied. Nine histories extended over one year and seven of these over two years. In 16 cases the infection had been present for a month or longer. The patients had been treated intermittently during these periods. Some were apparently cured and became reinfected. In 13 patients there were acute exacerbations of chronic processes. This group of 13 had a total of 57 attacks. A follow-up study of the persons who experienced their first acute attack under my observation was impossible. The likelihood is that a fair percentage later experienced exacerbations. It was necessary to return to the United States persons who were constantly handicapped by this condition despite therapy. When environmental factors were changed, many experienced spontaneous resolution of their condition. In a small percentage it became refractive. These were the ones in whom local hypersensitivity and chronic changes of the dermis and epidermis of the canal developed.

In a large percentage of cases it appeared that, in addition to the precipitating factor of trauma of the canal, there were other contributory causes. Swimming, absence of cerumen and increased heat and humidity were studied. Geographic and seasonal relationships of diseases of the external auditory canal are definite. The condition is more prevalent in the tropical than in the temperate zones, and more common in summer than in winter. Increased temperature and humidity are two conditions

conducive to infections of the external canal in persons normally inhabiting the temperate zones. In the tropics the skin undergoes certain metabolic changes associated with the increase in temperature. There is augmented activity of the cutaneous elements, with increased hyperkeratosis and maceration. The sweat and the sebaceous glands are also hyperactive. These intrinsic changes diminish the local resistance of the skin and prepare the way for infection. Once infection has been established, there is a reluctance to heal, with a tendency toward increased scar formation.

Twenty-four patients of this series contracted their infections on the tropical islands of the Pacific area, where humidity and temperature were elevated and sweating was increased. The vast majority of these patients had been swimming many times in streams and the ocean, and their infection was definitely related to the water. However, 4 persons became infected while on the transport, without being exposed to water through swimming, and the other 4 contracted the disease in the United States. Although the disease developed in a relatively small percentage of the vast number of troops who swam in tropical waters, the relationship between swimming and external otitis in general has long been apparent.

The absence of cerumen may be a contributing cause. There was no cerumen in 27 canals, and 5 had only small quantities. Not one patient possessed a large plug of wax. A survey of 200 routine examinations revealed that 16 per cent of the examinees had large quantities, 69 per cent small to moderate quantities and 15 per cent none. In view of this the high incidence of the absence of wax was striking.

The exudate was of the whitish gray or yellowish, blotting paper type in 18 cases. This resembled the type so often described in fungous disease as macerated, moist layers of desquamated epithelium. On culture of this exudate Ps. aeruginosa predominated. Neutrophilic leukocytes, epithelial cells and amorphous material were seen on smear. The more brilliant green, green-blacks and browns showed Ps. aeruginosa in 6 cases—in 2, combined with A. niger. In another case in which these brilliant colors were manifested, A. niger and diphtheroids were revealed. In the cases in which purulency was consistently present, staphylococci and B. proteus were demonstrated.

Two cases are worthy of special attention. In case 9 the patient complained of "ear trouble" for three years. A brownish black velvety mycotic growth lined the bony canal wall. This growth contained mycelial elements, epithelial cells and amorphous material. The skin beneath it was red, but there was no exudate. However, Ps. aeruginosa was cultured in addition to A. niger. In case 14 the patient had ten exacerbations in four years. The bony canal wall was covered with a brown fuzzy mycotic growth. When this was removed, a thin film of purulent

exudate was seen to cover the congested edematous epithelium. This pus contained gram-negative bacilli and neutrophilic leukocytes. Culture showed A. niger and diphtheroids.

Although none of these 32 ears (or any others which we had seen) were suggestive of an "id" reaction, the possibility was considered. In case 8 a dermatitis of the dorsa of both hands, followed by vesicles and cracks of the lips, developed about one week before the ear began to itch. In case 16 there was scabies for one month before the ear began to itch. In case 24 there was a superficial dermatitis on the back of the scalp for two months; Staph. aureus was isolated from it. In case 31 the dorsa of the hands showed a pyogenic dermatitis for three weeks before the ear began to pain. In these instances my associates and I were unable to classify any of the aural conditions as "id" reactions. Neither could any of the fungous infections be classified as related to an "id" reaction on any other part of the body.

An analysis of the results of treatment of a group of this nature under these conditions is limited. The treatment as a whole was simplified and carried out in the outpatient clinic. All ears showing pathogenic bacteria were treated by aspirating the debris with a fine suction tip. Often this had to be done without the aid of an ear speculum because of the swelling and pain. After cleansing, a wick soaked in 4.0 per cent aluminum acetate solution was inserted into the canal and kept moist for two days. If there was associated adenitis, a large wet dressing was applied to the ear. After forty-eight hours acute pain and much of the local edema had subsided. The debris in the canal was again carefully aspirated and an aluminum acetate pack reinserted. After seven days the canal was sprayed with a thin layer of sulfanilamide powder. One million units of pencillin was given routinely to these patients daily for seven days, but this procedure was discontinued because it had no appreciable effect on the disease.

The ears revealing fungi were treated by aspiration of the debris in the canal, after which 1 per cent thymol in meta-cresylacetate packs was applied for seven days. Then a sulfanilamide spray was used. In some early cases the ear underwent more active local treatment, with frequent manipulation of the canal and topical use of iodine, gentian violet medicinal and "merthiolate." It was soon discovered that gentle, not too frequent manipulation and use of mild, nonirritating solutions were desirable.

Follow-up study was impossible in most instances; consequently the results are reported with reservation. That the disease is chronic and recurrent, especially under tropical conditions, was fully recognized. And although 24 infected canals responded in some degree to the treatment, it is likely that many suffered exacerbations. "Apparently cured" has therefore been substituted for "cured." The average healing time of the

disease was 17.2 days, the shortest case requiring ten days and the longest three weeks. Two of those ears containing A. niger and Ps. aeruginosa and one containing Mucor and P. aeruginosa were apparently cured by this treatment. Two other ears, one with A. niger and Ps. aeruginosa and one with A. niger and diphtheroids, did not respond. The latter of these had more than 10 exacerbations in three years, and the skin of the canal was thickened and scarred. This phenomenon is rare in cases of pyogenic infection of the middle ear in which pus has drained over the skin for years.

Four infections recurred persistently while under observation, and it was necessary to evacuate the patients to the United States. In the remaining 4 cases the results are unknown.

The great inconvenience and the time lost because of a disease that is encountered in about half of the clientele of an ear, nose and throat clinic in the tropics are striking. Individual effectiveness is curtailed for approximately two and a half weeks. The carrying out of prophylactic measures against this condition in the tropics has been unavailing, chiefly because there were multiple exciting factors. Temperature, humidity and sweating were impossible to control during the war. Prohibiting swimming, use of showers and scratching of the ear was impracticable.

COMMENT

Much of the data pertaining to fungous disease of the ear has been inadequate and conflicting. Early textbooks on diseases of the ear, nose and throat and works on mycology stated positive opinions about the pathogenicity of the most common group of fungi found in the ear, the aspergilli. The authors recommended cleansing the canal and administering alcohol or salicylic acid in alcohol as ear drops. Their results were claimed to be excellent. More recent texts are much more comprehensive as to the classification and the treatment of this condition, but there is a marked difference of opinion concerning the frequency of the disease and the pathogenicity of the fungi commonly cultured when material is aspirated from the infected ears. Many mycologists consider them contaminants.

A review of the literature on the subject showed the majority of the publications to be incomplete and inadequate. Many articles were published dealing with simply clinical impressions of otomycosis. This has been proved unsatisfactory. The clinical signs and symptoms which have been described as typical of otomycosis are also characteristic of bacterial infection of the external canal. Until recently authors have emphasized the prevalence of fungous infection of the ear canal. During World War II it came to the attention of many writers that so-called fungous disease is not nearly so common as previously believed. An additional

finding was that Ps. aeruginosa is prevalent in these cultures. A study of 32 cases bears this out.

The exact role which fungi in the canal plays in these infections has not been settled. However, one does know that fungi are not commonly found in normal canals on routine culture. A. fumigatus elaborates a hemolytic endotoxin, and this is capable of altering local skin resistance. All of the saprophytes flourish in the presence of protein decomposition; yet they can exist in the ear without any awareness on the part of the patient. They can live simultaneously with organisms classified as common inhabitants of the ear and also with pathogenic bacteria. More than one fungus can exist in the ear at the same time. They can act as secondary invaders, but it is more common for bacteria to play this role. Positionally, they affect the bony canal wall most frequently and may cover the drum. The membranous canal wall and the pinna are involved less often. The middle ear is rarely infected by fungi. Mycetes may grow on or in cerumen. They likely contribute to the signs and symptoms of external diseases of ears in which pathogenic bacteria are also present. They rarely may be the sole causative agent.

Bacteria are almost always present in these infections. Ps. aeruginosa is cultured in two thirds of the cases. This organism and some others are not ordinarily common inhabiters of the ear and are classified as pathogenic. Ps. aeruginosa may exist alone or in combination with the fungi or with the bacteria classified as common inhabiters. The common inhabiters may exist alone or in association with fungi in these infections.

Cerumen will support fungous growth generously. It has no bactericidal effect on the common inhabiters and Ps. aeruginosa. It is reported effective against pneumococci and diphtheria bacilli and somewhat less effective against streptococci. It is significantly diminished in acute infections of the external canal.

Climate, humidity, race, season, local trauma and exposure to infecting agents are all contributory factors, but certainly more causative as a group than individually.

REPORT OF CASES

1. *History and Symptoms.*—First attack. Duration five days. No itching, no scratching. Severe pain, marked swelling. No wax. Frequent swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Moderate amount of amorphous whitish exudate. Swollen, red, tender canal. Sweetish odor. Gram-negative bacilli, neutrophilic leukocytes, amorphous debris. Culture: Ps. aeruginosa.

Course.—Apparently cured in fifteen days.

2. *History and Symptoms.*—Seventh attack. Duration of this attack two days. Chronicity four hundred and eighty-two days. Itching, scratching. Severe pain, marked swelling. No wax. Frequent swimming. Onset: New Guinea.

Clinical and Microscopic Observations.—Slight amount amorphous whitish exudate (blotting paper type). Swollen, red, tender canal. Gram-negative bacilli, neutrophilic leukocytes, amorphous material, epithelial cells. Culture: Diphtheroids.

Course.—Apparently cured in fifteen days.

3. *History and Symptoms.*—First attack. Duration two days. No itching, Severe pain, marked swelling. No wax. Moderate amount of swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Moderate amount of amorphous whitish exudate. Swollen, red, tender canal. Gram-positive cocci, gram-negative bacilli, neutrophilic leukocytes. Culture: Staph. albus, Ps. aeruginosa.

Course.—Apparently cured in fourteen days.

4. *History and Symptoms.*—First attack. Duration seven days. Moderate itching, occasional scratching. No pain, no swelling. No wax. Moderate amount of swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Slight amount of amorphous whitish exudate, speckled with black dots. Gram-negative bacilli, neutrophilic leukocytes epithelial cells, occasional spores. Culture: Ps. aeruginosa, A. niger.

Course.—Apparently cured in nineteen days.

5. *History and Symptoms.*—First attack. Duration two days. No itching, no scratching. Very severe pain, very marked swelling. Moderate amount of swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Moderate amount of amorphous whitish exudate (blotting paper type). Foul odor. Gram-negative bacilli, epithelial cells, amorphous material. Culture: Ps. aeruginosa.

Course.—Unknown.

6. *History and Symptoms.*—First attack. Duration ten days. Itching but no scratching. No pain, no swelling. Occasional swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Moderate amount of seropurulent exudate. Little reaction of canal wall. Few gram-negative bacilli. Culture: B. proteus.

Course.—Apparently cured in twenty days.

7. *History and Symptoms.*—Second attack. Duration of this attack six days. Chronicity sixty days. Frequent itching, moderate scratching. Severe pain, marked swelling. No swimming. No wax. Onset: On the boat.

Clinical and Microscopic Observations.—Desquamated epithelial cast with amorphous exudate (blotting paper type). Gram-positive cocci, gram-negative bacilli, epithelial cells, neutrophilic leukocytes. Culture. Staph. albus, diphtheroids.

Course.—Apparently cured in twenty days.

8. *History and Symptoms.*—First attack. Duration forty-two days. Chronicity forty-two days. Frequent itching, moderate scratching. No pain or swelling. No swimming. No wax. Onset: On the boat.

Clinical and Microscopic Observations.—Thick, moist, whitish exudate (blotting paper type). Little reaction of canal wall. Gram-negative bacilli, epithelial cells, neutrophilic leukocytes. Culture: Ps. aeruginosa.

Course.—Apparently cured in fourteen days.

9. *History and Symptoms.*—Second attack. Duration of this attack twenty days. Chronicity one thousand and ninety-five days. Itching, scratching. Severe pain, swelling. Frequent swimming. No wax. Onset: New Guinea.

Clinical and Microscopic Observations.—Brown-black velvet cast. No exudate. Slight congestion of bony canal wall. Many spores, mycelia, amorphous material, epithelial cells, gram-negative bacilli. Culture: A. niger, Ps. aeruginosa.

Course.—Apparently cured in ten days.

10. *History and Symptoms.*—Second attack. Duration of this attack four days. Chronicity seven hundred and thirty days. Itching, scratching. Pain, moderate swelling. Frequent swimming. No wax. Onset: New Guinea.

Clinical and Microscopic Observations.—Slight amount of serosanguinous whitish exudate (blotting paper type). Foul odor. Gram-negative bacilli, gram-negative cocci, epithelial cells, neutrophilic leukocytes. Culture: Ps. aeruginosa, Micrococcus.

Course.—Apparently cured in twenty-one days.

11. *History and Symptoms.*—Fourth attack. Duration of this attack two days. Chronicity four hundred and twenty days. Severe itching, moderate scratching. No pain or swelling. Occasional swimming. No wax. Onset: New Guinea.

Clinical and Microscopic Observations.—Slight amount of serosanguinous exudate. Redness around rim of canal and in canal. Gram-positive cocci, epithelial cells, neutrophilic leukocytes, red blood cells. Culture: Staph. albus.

Course.—Apparently cured in sixteen days.

12. *History and Symptoms.*—Sixth attack. Duration of this attack two days. Chronicity seven hundred and thirty days. Moderate itching, occasional scratching. Moderate pain but no swelling. Wax. Frequent swimming. Onset: Australia.

Clinical and Microscopic Observations.—Moderate amount of amorphous whitish exudate (blotting paper type). Foul odor. Gram-negative bacilli, amorphous material, gram-negative cocci. Culture: Ps. aeruginosa, Micrococcus.

Course.—Apparently cured in twenty days.

13. *History and Symptoms.*—First attack. Duration two days. Severe itching, frequent scratching. No pain, marked swelling. No wax. Occasional swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Moderate amount of amorphous whitish exudate. Red, edematous canal. Gram-negative bacilli, amorphous material. Culture: Ps. aeruginosa.

Course.—Apparently cured in ten days.

14. *History and Symptoms.*—Tenth attack. Duration of this attack forty-two days. Chronicity one thousand four hundred and sixty days. Severe itching, moderate scratching. Moderate pain, no swelling. No wax. Moderate amount of swimming. Onset: United States.

Clinical and Microscopic Observations.—Brown fuzzy coating of bony canal wall. Slight amount of exudate beneath it. Gram-negative bacilli, many spores and mycelia, neutrophilic leukocytes. Culture: A. niger, diphtheroids.

Course.—Three exacerbations in three months. Patient evacuated to the United States. Not cured.

15. *History and Symptoms.*—Second attack. Duration of this attack six days. Chronicity ninty days. Severe itching but no scratching. No pain, moderate swelling. No wax. Moderate amount of swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Moderate amount of amorphous greenish exudate. Foul odor. Gram-negative bacilli, gram-positive cocci, epithelial cells. Culture: Ps. aeruginosa, Staph. aureaus.

Course.—Apparently cured in seventeen days.

16. *History and Symptoms.*—First attack. Duration one day. Occasional itching, no scratching. No pain, no swelling. No wax. Frequent swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Weeping, denuded lesion of skin of external meatus. Serous exudate. Red blood cells, neutrophilic leukocytes. No bacteria seen. Culture: B. proteus.

Course.—Unknown.

17. *History and Symptoms.*—First attack. Duration two days. Occasional itching, no scratching. No pain, no swelling. Wax. Frequent swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Velvety white lining with slight amount of exudate on bony canal wall. Little reaction. Spores, gram-negative bacilli, epithelial cells, neutrophilic leukocytes. Culture: Ps. aeruginosa, Mucor.

Course.—Apparently cured in seventeen days.

18. *History and Symptoms.*—First attack. Duration fourteen days. Occasional itching and scratching. Occasional pain, no swelling. No wax. No swimming. Onset: On the boat.

Clinical and Microscopic Observations.—Moderate amount of amorphous whitish exudate (blotting paper type). Gram-negative bacilli, epithelial cells, neutrophilic leukocytes. Culture: Ps. aeruginosa.

Course.—Apparently cured in twenty days.

19. *History and Symptoms.*—First attack. Duration five days. No itching, no scratching. Moderate pain, moderate swelling. No wax. No swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Moderate amount of purulent exudate. Angry, red canal. Gram-positive cocci, epithelial cell, neutrophilic leukocyte. Culture: Staph. albus, Sarcina.

Course.—Apparently cured in eighteen days.

20. *History and Symptoms.*—First attack. Duration twenty-one days. No itching, occasional scratching. Moderate pain, no swelling. No wax. Occasional swimming. Onset: Philippine Islands.

Clinical and Microscopic Observation.—Slight amount of purulent exudate. Minimal reaction of canal wall. No bacteria seen. Rare epithelial cells. Culture: B. proteus, diphtheroid.

Course.—Apparently cured in sixteen days.

21. *History and Symptoms.*—Third attack. Duration of this attack four days. Chronicity one hundred and eighty days. Severe itching, moderate scratching. Moderate pain, moderate swelling. No wax. Occasional swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Moderate amount of amorphous whitish exudate. Foul odor. Gram-positive cocci, gram-negative bacilli, amorphous material, epithelial cells, neutrophilic leukocytes. Culture: Ps. aeruginosa, hemolytic Staph. aureus.

Course.—Apparently cured in twenty days.

22. *History and Symptoms.*—First attack. Duration four days. No itching, no scratching. Severe pain, marked swelling. No wax. Occasional swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Moderate amount of amorphous, greenish black exudate. External canal and wall impressively thickened and red. Gram-negative bacilli, epithelial cells, neutrophilic leukocytes. Culture: Ps. aeruginosa.

Course.—Apparently cured in fourteen days.

23. *History and Symptoms.*—First attack. Duration fourteen days. Severe itching, frequent scratching. No pain, no swelling. No wax. Moderate amount of swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Purulent exudate. Foul odor. Canal wall red. Gram-positive cocci, neutrophilic leukocytes, debris, phagocytes. Culture: Staph. albus and Staph. aureus.

Course.—Apparently cured in sixteen days.

24. *History and Symptoms.*—Tenth attack. Duration of this attack thirty days. Chronicity ten years. Severe itching, frequent scratching. No pain, no swelling. No wax. Moderate amount of swimming. Onset: United States.

Clinical and Microscopic Observations.—Slight amount of purulent exudate. Canal wall red. Gram-negative bacilli, gram-negative cocci. Culture: Ps. aeruginosa, Micrococcus.

Course.—Patient not cured. Evacuated to United States.

25. *History and Symptoms.*—First attack. Duration ten days. No itching, no scratching. Pain, moderate swelling. No wax. No swimming. Onset: On the boat.

Clinical and Microscopic Observations.—Slight amount of amorphous, whitish exudate (blotting paper type). Gram-negative cocci, gram-negative bacilli, epithelial cells, neutrophilic leukocytes. Culture: Ps. aeruginosa, Micrococcus.

Course.—Unknown.

26. *History and Symptoms.*—First attack. Duration two days. No itching, no scratching. Pain, no swelling. No wax. Occasional swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Slight amount of amorphous whitish exudate (blotting paper type). Rare gram-negative bacilli, gram-positive cocci, epithelial cells. Culture: Ps. aeruginosa, Staph. aureus.

Course.—Unknown.

27. *History and Symptoms.*—First attack. Duration twenty-one days. No itching, no scratching. Severe pain, swelling. Moderate amount of wax. No swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Moderate amount of amorphous, greenish black exudate. Foul odor. Gram-negative bacilli, gram-positive cocci, epithelial cells, neutrophilic leukocytes. Culture: Ps. Aeruginosa, Sarcina.

Course.—Apparently cured in sixteen days.

28. *History and Symptoms.*—Seventh attack. Duration of this attack fourteen days. Chronicity seven hundred and thirty days. No itching, no scratching. Moderate pain, moderate swelling. Wax. Frequent swimming. Onset: New Guinea.

Clinical and Microscopic Observations.—Slight amount of amorphous, greenish brown exudate. Foul odor. Gram-negative bacilli, gram-positive cocci, epithelial cells. Culture: Ps. aeruginosa, Staph. aureus.

Course.—Apparently cured in twenty days.

29. *History and Symptoms.*—Third attack. Duration of this attack four days. Chronicity, ninety days. Frequent itching, scratching. Moderate pain, no swelling. No wax. Occasional swimming. Onset: United States.

Clinical and Microscopic Observations.—Slight amount of amorphous, greenish exudate. Gram-negative bacilli, neutrophilic leukocytes, spores, epithelial cells. Culture: Ps. aeruginosa, A. niger.

Course.—Treated sixty days. Recurrence.

30. *History and Symptoms.*—First attack. Duration thirty days. Occasional itching and scratching. Severe pain, no swelling. No wax. Occasional swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Small whitish cast of canal. Little exudate. Gram-negative bacilli, gram-positive cocci, epithelial cells. Culture: Ps. aeruginosa, Staph. aureus.

Course.—Treated thirty days. Recurrence.

31. *History and Symptoms.*—First attack. Duration three days. Occasional itching, no scratching. Severe pain, no swelling. No wax. Occasional swimming. Onset: Philippine Islands.

Clinical and Microscopic Observations.—Moderate amount of amorphous whitish exudate (blotting paper type). Gram-negative bacilli, amorphous material, epithelial cell. Culture: Ps. aeruginosa, Staph. aureus.

Course.—Apparently cured in eighteen days.

32. *History and Symptoms.*—Second attack. Duration of this attack four days. Chronicity one thousand and four hundred and sixty days. Occasional itching and scratching. Moderate pain, no swelling. Wax. Frequent swimming. Onset: United States.

Clinical and Microscopic Observations.—Moderate amount of amorphous whitish exudate and purulency. Gram-positive cocci, epithelial cells, neutrophilic leukocytes. Culture. Staph. albus.

Course.—Apparently cured in twenty days.

SUMMARY AND CONCLUSIONS

The literature concerning otomycosis and cerumen has been reviewed.

Thirty-two cases of external disease of the ear have been studied.

Otomycosis requires further investigation from the points of view of incidence and causative factors.

Its frequency and prevalence have been overestimated.

The uncertainty as to whether the fungi commonly observed in the ear are pathogenic should be resolved.

Gram-negative bacilli, principally Pseudomonas aeruginosa, should be given more emphasis in cases of external otitis.

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VESTIBULAR FINDINGS BEFORE, DURING AND AFTER VESTIBULAR DAMAGE RESULTING FROM STREPTOMYCIN THERAPY

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THAT STREPTOMYCIN when administered in daily doses of about 2 Gm. over a period of from two to twelve weeks may cause considerable damage to the vestibular apparatus was reported by Brown and Hinshaw,[1] Hinshaw, Feldman and Pfuetze[2] and Marden[3] in 1946. Fowler and Seligman[4] made a similar report in 1947.

Brown and Hinshaw expressed doubt as to whether the lesion is in the vestibular end organ or in the brain. In 1947 Skoog[5] proved that Ménière's syndrome can be produced in a guinea pig by a lesion of the brain stem. It must, therefore, be observed that Ménière's syndrome may follow a lesion of the vestibular nuclei in the brain stem as well as a lesion of the peripheral end organ.

An analysis of the vestibular data obtained on 3 patients treated with streptomycin at the Hospital of the University of Pennsylvania forms the basis of this paper.

CASE 1.—Mr. W. J. S., 45 years of age, was treated with 3 Gm. of streptomycin daily between May 16 and June 20, 1946, for bacterial endocarditis. The first vestibular examination was made after symptoms of vestibular disturbance had developed. In chart 1 it will be noted that in three examinations made on June 18, July 1 and July 29, 1946

Read before the Section on Otolaryngology of the College of Physicians of Philadelphia, Feb. 19, 1947.

From the Section of Neuro-otology of the Department of Otolaryngology of the University of Pennsylvania School of Medicine.

1. Brown, H. A., and Hinshaw, H. C.: Toxic Reaction of Streptomycin on Eighth Nerve Apparatus, Proc. Staff Meet., Mayo Clin. **21**:347-352 (Sept. 4) 1946.

2. Hinshaw, H. C.; Feldman, W. H., and Pfuetze, K. H.: Treatment of Tuberculosis with Streptomycin, J. A. M. A. **132**:778-782 (Nov. 30) 1946.

3. Marden, P. A.: Streptomycin Therapy, read before the Section of Otolaryngology of the College of Physicians of Philadelphia and the Philadelphia Laryngological Society, Dec. 18, 1946.

4. Fowler, E. P., Jr., and Seligman, E.: Otic Complications of Streptomycin Therapy, J. A. M. A. **133**:87-91 (Jan. 11) 1947.

5. Skoog, I.: On the Vital Staining of the Central Nervous System, Acta oto-laryng. **25**:365, 1947.

there were no responses to turning; that the caloric stimulus elicited some evidence of a vestige of vestibular function. There was no complaint of tinnitus or deafness in either ear. Audiograms taken on June 18, June 24 and July 5, 1946 (chart 2) would indicate a drop in hearing for the

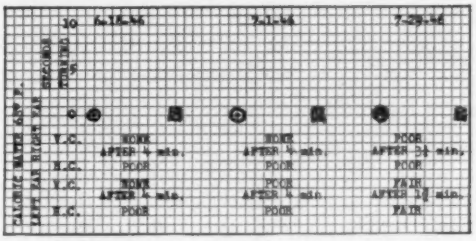

Chart 1 (case 1).—Results of tests made to determine vestibular fuction at three intervals after the start of streptomycin therapy (May 16, 1946). In this and in charts 3 and 5 nystagmus after turning to the right is indicated by a circle; nystagmus after turning to the left, by a square; vertigo after turning to the right, by a black dot; vertigo after turning to the left, by a cross. *V. C.* stands for vertical semicircular canals; *H. C.*, for horizontal semicircular canal.

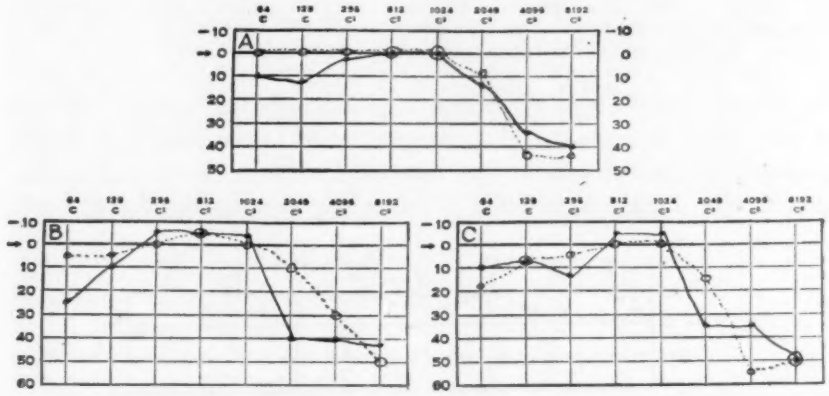

Chart 2 (case 1).—Audiograms made on June 18 (*A*), June 24 (*B*) and July 5, 1946 (*C*). The right ear is represented by a solid line; the left ear by a broken line.

2048, 4096 and 8192 tone range. It is difficult to attribute this to the effects of the streptomycin inasmuch as no audiogram was made before therapy was started and there was no complaint of tinnitus at any time; the latter symptom was observed by Brown and Hinshaw to precede deafness when this occurred in their cases. We were also unable to observe the changes in the vestibular disturbances as they took place in this patient, owing to the fact that the first vestibular examination was made after symptoms of vestibular damage had been present.

Case 2.—Mr. J. R., 40 years of age, was treated for pulmonary tuberculosis and received 1.8 Gm. of streptomycin daily between Oct. 8

and Oct. 31, 1946. Simple mastoidectomy had been performed on the left side several years before this. Examination of the left ear revealed a tortuous external auditory canal. The tympanic membrane was intact.

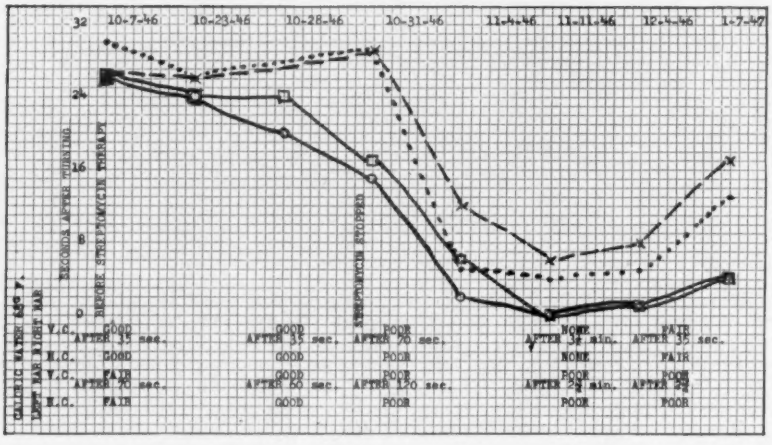

Chart 3 (case 2).—Results of tests made to determine vestibular function before and at seven intervals after the start of streptomycin therapy. See legend of chart 1 for explanation of the symbols and abbreviations used.

A postauricular fistula was present. The right ear was normal. In chart 3 the results of vestibular examinations made before, during and after a course of streptomycin therapy show that when vestibular damage began to take place, the duration of nystagmus after turning began to de-

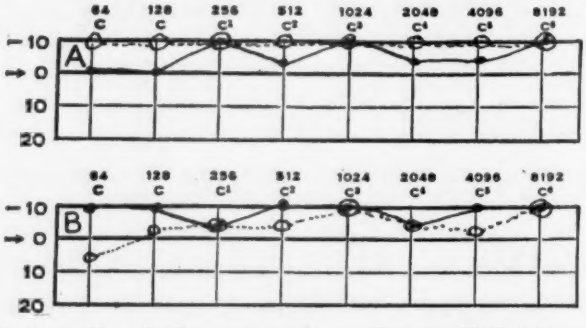

Chart 4 (case 2).—Audiograms made on Oct. 8, 1946 (*A*) and Oct. 31, 1946 (*B*).

crease first; that the decrease in the duration of vertigo followed; that when streptomycin was discontinued on October 30, vestibular dysfunction continued to increase; that no nystagmus was obtained after turning but that there was vertigo in response to turning of low duration. Approximately fifteen days after the drug had been stopped, vestibular function began to improve somewhat, and on Jan. 7, 1947 there was a

considerable return of vertigo in response to turning, and nystagmus of appreciably shorter duration was obtained after turning at this time. It will be observed that the vertigo and the ocular responses did not suffer equally as a result of the streptomycin therapy in this case, and that when the vestibular function began to return the improvement was much greater in the vertigo than in the nystagmus after turning. The hearing was not affected in this patient at any time. Two audiometric tests were done, the first on Oct. 8, 1946 (chart 4*A*) and the second on Oct. 31, 1946 (chart 4*B*). It will be seen that the hearing was normal throughout the entire tone range.

Case 3.—Mrs. B. S., 28 years of age, received 2 Gm. of streptomycin daily between Oct. 29 and Dec. 18, 1946, for the treatment of renal tu-

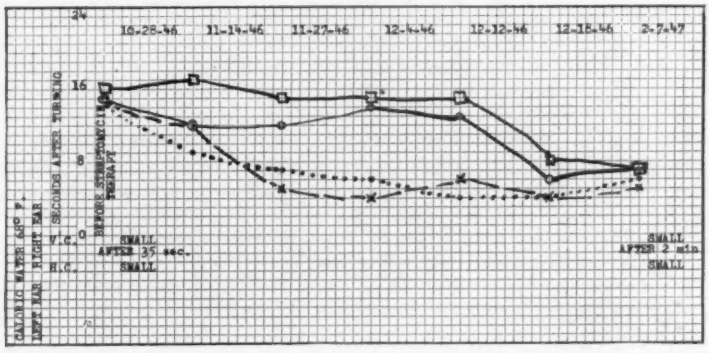

Chart 5 (case 3).—Results of tests made to determine vestibular function at six intervals after the start of streptomycin therapy. See legend for chart 1 for explanation of the symbols and abbreviations used.

berculosis. Examination of the ears revealed a left chronic purulent otitis media of long standing in the left ear. Vestibular examination on October 28 (chart 5), before streptomycin therapy was started, revealed a proportionate reduced response in nystagmus and vertigo after turning. The right vestibular apparatus gave a normal response to caloric stimulation. The caloric stimulation was not carried out in the left ear because of the chronic infection of the middle ear. About seventeen days after streptomycin therapy had been started, it will be observed there was considerable reduction in the response of vertigo after turning, and this continued until after December 12. On December 18 the duration of nystagmus after turning was found to be definitely reduced but not to the same extent as that of vertigo. There was no impairment of hearing as a result of the streptomycin therapy, as evidenced by the audiograms taken on Oct. 28 and Nov. 14, 1946 and Feb. 6, 1947 (chart 6). (It will be observed that there was some impairment of hearing in the left ear before streptomycin therapy was started. The hearing by bone

conduction was good. The second audiogram taken about seventeen days after the administration of streptomycin had been started showed a decided improvement of the hearing. The infection of the middle ear was also improved, apparently by the streptomycin. The audiogram taken on Feb. 6, 1947, about nineteen days after streptomycin therapy had been discontinued, showed that most of the improvement in hearing had been maintained. The left middle ear was again found to be discharging.)

Each hair cell in the ampullae of the semicircular canals is believed to pick up the impulses arising from disturbances of the endolymph.[6] These impulses are conveyed through the vestibular nerve to the vestibular nuclei in the brain stem. At this point there is a division of the

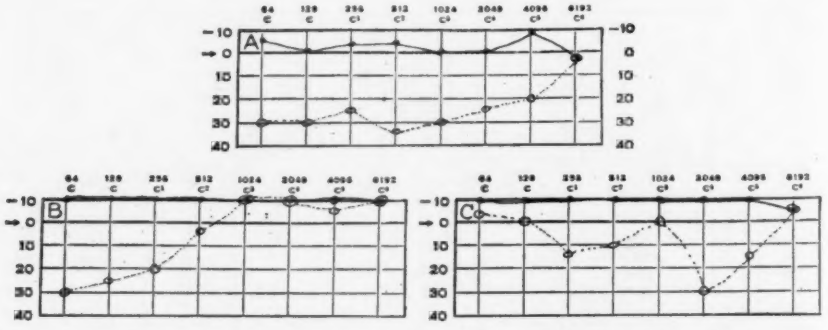

Chart 6 (case 3).—Audiograms taken on Oct. 28, 1946 (*A*), Nov. 14, 1946 (*B*) and Feb. 6, 1947 (*C*). The right ear is represented by a solid line; the left ear by a broken line.

pathway, one division conveying impulses through the cerebellum for the sensation of vertigo, the other division conveying impulses through the posterior longitudinal bundles to the nuclei of the external ocular muscles,[7] for the vestibular component of the nystagmus. In view of this, with a lesion in the labyrinth one would expect the responses of nystagmus and vertigo to be equally affected. With a central lesion—that is, one occurring after the division of the nerve fibers from the horizontal semicircular canal has taken place—a disproportionate reduction in the responses of nystagmus and vertigo may be expected. This is precisely what has taken place in cases 2 and 3.

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6. Jones, I. H.: Equilibrium and Vertigo, Philadelphia, J. B. Lippincott Company, 1918.

7. If the horizontal semicircular canals are stimulated, the muscles involved would be the external rectus (rectus lateralis) in one eye and the internal rectus (rectus medialis) in the other eye; if the vertical canals were stimulated, the external and internal rectus muscles, along with the superior and inferior oblique muscles, would be involved.

The fact that deafness has occurred in several cases reported by others and the fact that Molitor and his co-workers[8] have not been able to demonstrate a lesion of the brain in dogs previously given large doses of streptomycin until evidence of damage to the vestibular apparatus had appeared would cause some doubt as to the possibility of the lesion being central. If the work of Molitor and his associates is to be accepted as final, these findings could be explained only on the basis that there are in the ampulla a set of hair cells for picking up the impulses producing nystagmus and a separate set of hair cells for picking up the impulses eliciting vertigo.

The establishment of these hypotheses must rest on further laboratory experimentation with animals and, perhaps, on examination of the labyrinths of those tuberculous patients in whom vestibular damage may develop as a result of streptomycin therapy and who succumb to their malady.

1737 Chestnut Street.

8. Molitor, H.; Graessle, O. E.; Kuna, S.; Mushett, C. W., and Silber, R. H.: Some Toxicological and Pharmacological Properties of Streptomycin, J. Pharmacol. & Exper. Therap. **86**:151, 1946.

DIZZINESS AS A PROBLEM IN DIAGNOSIS IN AN ARMY HOSPITAL

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THE PATIENT who complains of dizziness presents a serious problem to the physician. The solution of the problem is frequently extremely difficult and requires a thorough study of the patient in order to evaluate the symptom, to locate its origin and to determine its cause when possible. Dizziness may be the only symptom or it may be one of a group of symptoms. It is a sensation or an awareness that is not within the patient's usual experience. This causes great difficulty in describing accurately what is felt. The word "dizziness" is used to cover a wide variety of sensations. Only by careful questioning can a true impression be formed.

Solution of the problem is important, first, because dizziness may be the only symptom of a deep-seated and serious pathologic process and, secondly, because the symptom itself is disabling. The safety of the patient and of those dependent on him is often in danger. This presents a particular problem in the Army, where the efficient function of a unit depends on the coordination of each person in it. During a period of approximately two and a half years, a large group of patients who complained of dizziness were studied at an American Air Force regional hospital. The bulk of these patients were referred from various branches of the armed forces, and many of them had been overseas. Also included were patients seen in the dependents' clinic. These patients were seen by the otorhinolaryngologic service or in consultation with other services.

The purpose of this paper is to present a group of representative cases rather than a statistical report. Each case was given a thorough medical work-up. Particular stress was laid on examination of the central nervous system, the eye, the ear, the nose and the throat. The examination also included a dental check-up for the elimination of any focus of infection.

Considerable time was given to eliciting the history of dizziness. Care should be taken to avoid building up a history by suggestion. The pa-

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tient's willingness to cooperate and vagueness of his symptoms combined often give an inaccurate history. The following sensations are most often described by the patient:

1. The rotation of objects about the patient or the sensation of the patient himself spinning. This is a true rotary vertigo and is usually of sudden onset. It is so definite that the patient may be able to give the direction of the turning.
2. The sensation of unsteadiness or giddiness. This is more marked when the patient is in motion; for example, while walking, turning or riding. Changing position suddenly from the prone to the standing or the reverse position enhances the feeling of unsteadiness. The patient will often describe the feeling as "drunkenness" and may frequently describe his dizziness as brought on while in bed and turning on one particular side.
3. Loss of balance in the dark or in the water.
4. Difficulty in fixing his gaze on an object while he himself is moving. This is often described as blurring of vision; for example, the patient may be unable to read while riding in a car or while walking.
5. The feeling that he is deviating in one direction while walking. This sensation may be severe and may be coupled with unsteadiness in gait. The patient speaks of falling to one side.

The mode of onset, the duration, the severity and the recurrence of the dizziness should be inquired into. The severity of the symptoms may vary from slight unsteadiness lasting a few minutes to violent vertigo that confines the patient to bed. Patients often describe a fainting spell as dizziness when a careful history would indicate the precipitating cause of the syncope. The patient may have other complaints associated with the dizziness such as a loss of hearing, tinnitus, headaches, nausea, vomiting, staggering and falling. The history should be completed by an inquiry into the various systems, particularly looking for indications of involvement of the ears, infectious diseases, toxic states and injuries.

The physical examination in our cases included a thorough neurologic work-up and a study by an ophthalmologist. A medical consultation was obtained in order to determine the presence of any systemic disease such as cardiovascular disease, nephritis or endocrine disturbances as well as to rule out vasovagal states and hypoglycemia. Dental and urologic consultations were used to determine any focus of infection.

In examinations of the ear, nose and throat particular attention was paid to the ear. This examination included the tympanic membrane, the nasopharynx and the eustachian tube. Then a thorough functional work-up followed. This included:

1. Examination for spontaneous phenomena.
   - (*a*) Romberg sign
   - (*b*) Past pointing
   - (*c*) Adiadokokinesis
   - (*d*) Gait—staggering type or unsteadiness after a quick turn to the right or left.
   - (*e*) Walking with a wide base
   - (*f*) Nystagmus—its direction, type, regularity and degree

2. Examination of the vestibular portion of the nerve.
   (*a*) The labyrinth was stimulated first with cold water. 15 cc. of cold water at 20 C. (68 F.) was used. If no response was obtained, then larger quantities of cold water were employed. Patients who showed no response with 30 cc. of cold water were then stimulated by mass irrigation. With this method a stream of cold water was directed into the canal for five minutes. If no response was obtained, the labyrinth was considered to be without function.
   (*b*) Turning test in a Bárány chair.
   (*c*) Galvanic stimulation. The response to stimulation by galvanic current with the quipment available produced falling and tilting of the patient but not nystagmus. This method was not satisfactory in our hands and was not used in the study of these patients.
   (*d*) The patient was given a swimming pool test when there was bilateral loss of labyrinthine responses.

In using the cold water caloric stimulation we found that a moderate difference between the responses of the two labyrinths is significant of a pathologic vestibular condition. It indicates that one labyrinth is more active than the other. This is true even when the duration of the nystagmus of each side falls within the normal limits.

3. The auditory portion of the nerve was then examined with an audiometer. Determinations of the hearing by air and by bone conduction were made, masking devices being used when indicated.

The findings were then summarized in a statement noting the presence of spontaneous phenomena, the response of the labyrinth to stimulation and the type and amount of hearing lost.

CASES STUDIED

A brief summary of some of the cases studied follows. These have been grouped as clinical entities on the basis of the symptoms presented.

(1) Group with Ménière's disease
(2) Group presenting a single attack of vertigo
(3) Group presenting a prolonged history of vertigo

These are divided into those cases in which there is a pathologic process in the labyrinth, those cases due to systemic disease and those cases due to an intracranial pathologic condition.

1. *Group with Ménière's Disease.*—These patients have recurrent attacks of vertigo associated with tinnitus and loss of hearing, nausea and vomiting. This is a classic syndrome though any of these symptoms may occur alone with possibly later development of the others. Although it is now generally accepted that the pathologic process in this condition is due to hydrops of the labyrinth, we still do not know the cause of the mechanism by which hydrops is produced. A variety of causes have been proposed. One group believes the condition is due to disturbed water balance through the retention of the sodium ion. There are others who be-

lieve that the disturbance is due to allergy, and their attack on the problem is made by the use of histamine. Still others believe that vitamins and their effect on the vascular system, particularly nicotinic acid, may have some causal relation to the production and disturbance of hydrops. Some believe that foci of infection—such as diseased tonsils, abscessed teeth, chronic prostatitis, infected sinuses, as well as a sluggish gastrointestinal tract—are at the base of the disease. With such a multiplicity of factors that are likely to produce or aggravate the symptoms of a patient with Ménière's syndrome, the physician must necessarily investigate each cause thoroughly before attempting treatment. He may then find it necessary to attempt more than one form of therapy before obtaining a good result.

CASE 1.—H. H., aged 40, was admitted to the hospital because of frequent attacks of severe vertigo preceded by tinnitus associated with nausea, vomiting and vertigo. These attacks began about a year before admission and became more and more frequent. Prior to admission to the hospital the patient was having two to three attacks a week. The vertigo would last five to six hours. The patient noticed loss of hearing in both ears after an attack. During his stay in the hospital, the patient was examined and observed during several attacks. These were the significant findings: A perceptive type deafness was revealed, more marked on the left side. Caloric stimulation of his labyrinths revealed a vestibular imbalance. The right labyrinth was more active than the left. In a typical attack the patient presented the following picture: He was violently dizzy; he tended to fall to the left—this tendency to fall was modified or changed by changing the direction and position of his head; a third degree nystagmus to the left was present. The patient preferred to lie absolutely still, flat on his back. During the interlude between attacks there were no signs or symptoms. Neurologic examination gave negative results. An electroencephalogram was normal. He had several abscessed teeth; after their removal he had only one attack. He was followed for two months after the teeth were removed. It was also noticed that his hearing improved. A trial of the Furstenberg regimen with limitation or total absence of salt intake plus the administration of adequate doses of ammonium chloride, doses of nicotinic acid and histamine had failed to produce any relief in this man's symptoms. The diagnosis was true Ménière's disease.

CASE 2.—S. S., aged 35, gave a history of a sudden onset of fulness in the right ear, loss of hearing and tinnitus. This was followed by severe vertigo to the left, nausea and vomiting. The first attack occurred one month before admission. He had had several severe attacks lasting two to three days each, prior to coming into the hospital. He was relieved only by lying quietly in bed on his left side. On standing during the attack he fell to the left. In the interlude between the severe attacks a mild vertigo persisted. On examination these significant findings were obtained: a spontaneous nystagmus, second degree, to the right during the attack; imbalance between the labyrinthine responses on the right and left sides, as shown by the caloric test; a greatly hypoactive right labyrinth; a 52 per cent loss of hearing in the right ear and a normal left ear shown by the audiogram. The patient was given ammonium chloride with a salt-free diet. He was also given a course of nicotinic acid and a course of injections of histamine. No focus of infection could be found. With rest in the hospital his attacks became less severe and less frequent. He was seen one year later. He still had attacks of vertigo, but these were now less frequent and less severe. Vestibular tests done one year later gave normal results. His hearing had improved. The diagnosis was true Ménière's disease.

CASE 3.—S. L., aged 27, gave a history of a sudden onset of severe vertigo associated with nausea, vomiting and a staggering gait. The patient described a true rotational type of dizziness. The attacks were short in duration, lasting twenty minutes and occurring two to three times a month. He did not complain of ringing in his ears. On caloric examination the patient showed greater response from the left labyrinth; the audiogram showed a 50 per cent loss in the right ear. The patient was placed on a Furstenberg regimen and improved. He was discharged from the hospital with the diagnosis of true Ménières disease.

CASE 4.—W. B., aged 44, gave a history of a sudden onset of vertigo with nausea and vomiting. The attacks lasted three days. The patient was confined to bed but experienced severe dizziness when he moved his head. He was hospitalized for the first time in 1943. Since that time he had had one or more attacks each month. Each attack lasted two or three days. The patient did not complain of ringing in his ears but did have a total loss of hearing in his right ear. The following significant findings were obtained: The audiogram revealed the right ear to be completely deaf, the left ear normal; caloric stimulation of the right ear gave no response while response in the left ear was diminished; the turning test showed a significant imbalance between the two labyrinths. The patient was followed for about one year. During that time he had several attacks of vertigo, which occurred at six to eight week intervals.

This case represents Ménière's syndrome in a person with only one functioning labyrinth.

2. *Group Presenting a Single Attack of Vertigo.* This group presented the following symptoms:

(*a*) A single attack of true rotational vertigo.
(*b*) No recurrence
(*c*) Minimal or no ear symptoms
(*d*) A definite imbalance between the two labyrinths when stimulated by caloric tests
(*e*) Headache

Various names have been given to this group to distinguish it from the group with true Ménière's syndrome. The condition has been called pseudo Ménière's syndrome, Ménière's syndrome without hearing defect, toxic labyrinthitis, and many other names. It is important to realize that it is a distinct entity, different from true Ménière's syndrome. Since its prognosis is much better than that for Ménière's disease, one is liable to form faulty conclusions if one confuses it with Ménière's syndrome and claim much for the various types of treatments. The following group of cases fall into this category.

CASE 5.—W. N., aged 24, was admitted to the hospital with a history of sudden onset of severe vertigo. The patient described the sensation of things whirling about, a tendency to fall and to walk to the left. The symptoms were aggravated by sudden movement. There were no auditory symptoms. The patient complained of a severe headache. These were the significant findings: a positive Romberg sign; nystagmus to the left of second degree; a definite imbalance between the right and the left labyrinth on caloric stimulation and rotation tests, the right labyrinth being much more active than the left; normal audiograms. The patient was kept in bed for ten days, during which time the dizziness dis-

appeared gradually. A complete study of this patient failed to reveal any precipitating cause. The patient was followed for six months after the acute attack and had no recurrence.

CASE 6.—R. C., aged 25, was admitted to the hospital with a history of a sudden onset of dizziness. He described the environment as spinning around him. He became violently sick and vomited several times, complained of headache, was unsteady on his feet and had a tendency to fall to the right. There were no ear symptoms. The significant findings were as follows: The patient had a definite rotary nystagmus of second degree; the right labyrinth was more active than the left; the audiogram was normal. The patient was followed in the hospital for one month. The vertigo and nystagmus disappeared after two weeks. He had chronic infection of his tonsils. These were removed. There were no recurrences of the attacks of dizziness. It was felt that the diseased tonsils may have been a factor in the production of the vertigo.

CASE 7.—B. L. C., aged 7, was admitted to the hospital twenty-four hours after the onset of a severe attack of dizziness, which was associated with nausea, vomiting and headache. The child was unable to stand and was comfortable only when lying in bed. There were no ear symptoms. The dizziness lasted ten days. Examination revealed an acutely distressed child, unable to stand and desiring to lie still in bed. There was nystagmus to the right of a third degree intensity. The audiograms and examination of the ears gave normal results. Neurologic examination failed to reveal any definite pathologic condition. Dizziness persisted for ten days. At the end of two weeks nystagmus could not be detected. In a six month check-up there had been no recurrence.

This is the youngest patient we saw with a true vestibular imbalance of sudden onset and of unknown origin. A thorough study of this child failed to reveal any factor which may have produced her vertigo.

CASE 8.—S. B., aged 25, gave a history of having bent over to pick up something from the floor, and when he straightened up he became violently dizzy. The dizziness persisted; he became nauseated and vomited several times. He described the sensation of dizziness as a feeling that things were revolving about him. The patient had a staggering gait with a tendency to fall to the left. There were no ear symptoms. The significant findings were as follows: a positive Romberg sign, staggering gait and walking with a wide base. The audiograms were normal. Examination of the vestibular apparatus showed a definite imbalance of both labyrinths on caloric stimulation. This was true also of the response to rotational tests. The dizziness persisted for ten days. There were no recurrences. A causative factor was not determined.

CASE 9.— B. G., aged 38, had a sudden onset of dizziness with headache. The patient described a neuralgic type of pain which involved the right side of his head and followed closely the distributions of the fifth nerve. He also described a sensation of pain produced by high-pitched noises. The patient felt dizzy; he described his sensation as a true rotational vertigo and felt definitely imbalanced, having a tendency to fall to the left. These significant findings were obtained: He had a herpetic eruption in the right canal. Vestibular tests using the caloric technic revealed an imbalance between the labyrinthine responses; there was hyperactivity in the right labyrinth. Neurologic examination, including a spinal puncture, gave negative results. The dizziness persisted for about ten days, gradually disappearing. There were no recurrences in an eight month follow-up period. The audiogram was normal.

This was probably a virus infection involving the vestibular portion of the eighth nerve and the fifth nerve. This would follow closely the type of lesion described as the Ramsay-Hunt syndrome.

CASE 10.—G. E., aged 21, became dizzy while eating. The room spun around him. He had difficulty focusing his eyes. He drove his own car to the hospital. He became violently sick, stopped the car, and vomited several times. The patient did not complain of tinnitus or deafness. He complained of a definite lag in focusing his eyes when he changed the position of his head. Physical examination revealed an acutely distressed man who preferred to lie quietly. Any movement of his head produced dizziness. He had a spontaneous nystagmus to the left, of rotary type. While standing with eyes closed, there was slight swaying. His gait was steady until he turned around quickly; then he became unsteady. Caloric examination revealed a markedly diminished reaction in the right labyrinth. This improved over a two month period. The audiogram showed a marked dip at 2,048 decibels in both ears, being more marked in the right ear. At the end of two months the patient was asymptomatic, his hearing had improved, and his reactions to caloric tests were normal. A complete study of this patient failed to reveal any definite pathologic condition that might have produced the attack. He was given no other treatment than rest.

CASE 11.—N. K., aged 23, had a sudden onset of dizziness while he was watching a "show". He noticed on leaving that he staggered to the left. Later he became nauseated and vomited. He remained in bed two days and was unable to retain food. He was admitted to the hospital on the third day complaining of dizziness and severe headache. The significant findings were as follows: Nystagmus to the right of second degree intensity was present; caloric stimulation of the right labyrinth failed to produce nystagmus; the audiogram was normal. Complete study of this patient failed to reveal any other significant abnormality. During his course in the hospital the dizziness gradually subsided over a four week period. Caloric stimulation of his right ear at the end of six weeks showed no recurrence of its sensitivity. Turning tests performed at intervals at first showed an imbalance between the responses of the right and the left labyrinth. This imbalance diminished as the patient recovered, indicating that compensation was taking place. Audiograms were normal.

3. *Group Presenting Prolonged History of Vertigo.*—The dizziness may be due to a pathologic condition within the labyrinth, or may accompany systemic diseases, or may be due to some intracranial disease. Examples of this group follow:

CASE 12.—W. G. J., aged 23, was admitted to the hospital after a motorcycle accident in which he sustained a fracture of the skull involving the left parietal and temporal bones. Following recovery of consciousness, the patient complained of impaired hearing in the left ear, tinnitus and dizziness. This dizziness was a true turning type and was aggravated by changes in position, especially by turning quickly. He also complained of inability to focus on an object while walking or riding. He had a tendency to deviate to the left while walking and a direction tendency to fall to the right. The significant findings were as follows: There was no spontaneous nystagmus; the audiogram showed the right ear to be normal and the left ear revealed a marked dip at 1,024. The vestibular test with cold water showed a complete loss of vestibular response of the left side. The patient walked with a wide base. His symptoms gradually diminished over a two month period of observation. At the end of that time he still had difficulty making

an about face to the right. The feeling of unsteadiness was still present but definitely diminished.

In this case the fracture undoubtedly involved the labyrinth on the right side, destroying its function. It is interesting to note that compensation was taking place, although it was not complete.

Case 13.—E. R. C., aged 49, gave a history of having had severe otitis media in 1932 which was complicated by meningitis. He recovered from his meningitis but was left with a total loss of hearing in his left ear and dizziness which had persisted to the time of admission. The patient described the dizziness as a feeling of insecurity while walking in the dark or on rough ground or when turning rapidly. The significant findings follow: The Romberg sign was present, the swaying slight but definite; the audiogram revealed normal hearing in the right ear and a total loss of hearing in the left ear; the vestibular test with cold water failed to produce nystagmus on the left side. There was no change in this patient's symptoms during a follow-up of two months.

The labyrinth was destroyed by infection, either by labyrinthitis or direct infection of the meninges.

Case 14.—N. N., aged 24, had otitis media in the left ear three years before admission to this hospital. A simple mastoidectomy was done at that time. One year later the otitis media recurred, and this time he complained of dizziness and headache. A modified radical mastoidectomy was done. On admission to this hospital the patient complained of headache, discharge from the left ear and dizziness which he described as lightheadedness. A radical mastoidectomy was done and a large cholesteatoma was found occupying the region of the antrum in the mastoid cavity. This patient did not have nystagmus, the Romberg sign was not present, and the audiogram showed a 55 per cent loss of hearing in the left ear. The vestibular test revealed a total loss of function of the left labyrinth. The patient made an uneventful recovery following mastoidectomy. The dizziness described as lightheadedness persisted.

In this case labyrinthitis had been caused by chronic infection in the mastoid process. We believe that compensation will not be any greater and that the patient's dizziness or lightheadedness will continue as one of the residuals of losing the function of one labyrinth.

Case 15.—J. T. H., aged 27, had chronic discharge from the right ear of five years' duration. Three days before admission to the hospital the patient complained of severe pain deep in this ear, increase in discharge and severe vertigo. Hearing was greatly diminished in the right ear. The significant findings follow: An attic perforation was present in the right ear, with a foul discharge; there was a large quantity of cholesteatomatous material; a fistula test produced marked vertigo with nystagmus to the left; the patient had a 50 per cent loss of hearing in his right ear; roentgenograms revealed a sclerotic mastoid process. A neurologic examination ruled out intracranial involvement. A radical mastoidectomy was done and a cholesteatoma was found which had eroded the horizontal semicircular canal. The fistula was definitely identified. A small amount of fluid escaped during the operation. Following the operation the patient was extremely dizzy and had nystagmus to the right. The dizziness gradually diminished, and the nystagmus disappeared within two months. On check-up six months later the mastoid cavity had healed. The patient complained of slight dizziness if he moved fast; the nystagmus had cleared completely; the hearing in the right ear showed a 52 per cent loss.

This case again illustrates vertigo that is caused by infection of the labyrinth secondary to disease of the mastoid.

CASE 16.—E. F., aged 32, had a discharge from the right ear for ten years before admission. One week prior to admission the patient began to have headaches and dizziness. His ear discharged more profusely. On examination a large perforation of the right drum membrane in the region of the attic was found with cholesteatomatous material present. The patient gave a positive reaction to the fistula test; he became dizzy, and nystagmus to the left developed during the test. The audiogram showed a 52 per cent loss in the right ear. The roentgenogram revealed a sclerotic right mastoid. Neurologic examination gave negative results. A radical mastoidectomy was done. A cholesteatoma was found in the attic and mastoid antrum. This had eroded the horizontal semicircular canal. The fistula was not disturbed. Following the operation the patient had a moderate amount of dizziness and nystagmus to the right. Examination three months later revealed a well healed mastoid cavity with both the cochlea and the labyrinth on the right side functioning. The patient did not complain of dizziness.

Miscellaneous Groups.—The following group of 4 cases are presented because they represent a total loss of vestibular function in both ears. Stimulation by all means available failed to produce any labyrinthine response. It is felt that these represent a destruction of vestibular function central to the end organ. These cases have been reported and more fully described by Captain Chusid and Colonel DeGuitterez-Mahoney.

CASE 17.—A. S., aged 24, an enlisted man, had an attack of scarlet fever in March 1941. He was hospitalized for twenty-eight days at that time. Four to five months later he first noticed difficulty with his sense of balance. He staggered, especially when walking in the dark. There was a gradual loss of hearing in the left ear and tinnitus. On one occasion while swimming he had great difficulty in orientating himself and almost drowned. His staggering gait increased. He also complained of being unable to focus on objects while he was walking or riding in a vehicle. The patient presented the following significant findings: He had a total loss of hearing in his left ear; his right ear was normal; the Romberg sign was present; he walked with a broad base and a staggering gait; caloric stimulation and turning in the Bárány chair produced no reaction in either ear. The patient was given a swimming pool test, during which he was completely disoriented while in the water and had a great fear of submerging.

This man was in an area in which typhus was endemic; it is possible that he may have had this disease. The relation of the scarlet fever to his bilateral complete loss of vestibular function is not clear.

CASE 18.—G. D. S., aged 26, had a primary and a secondary syphilitic lesion in the spring of 1944. Six months later headache developed, followed in a few days by loss of sense of balance and staggering. The staggering was worse at night. The patient was aware of an increased loss of hearing and tinnitus. He also noticed that he was unable to fix his gaze on an object while he was moving. The significant findings follow: a repeatedly positive reaction to the Kahn test; a spinal fluid curve of 5555451100 with a positive Wassermann reaction and a total protein content of 40 mg. per hundred cubic centimeters; the electroencephalogram was normal; the Romberg sign was present; there was a total loss of response to stimulation by caloric and rotation tests on each side; the patient had a staggering gait; the audiogram revealed a 30 per cent loss on the left side and an 87

per cent loss on the right side. The patient was given the swimming pool test. While in the water with eyes closed, he was disoriented and afraid of drowning in deep water. He was given a course of antisyphilitic treatment and showed considerable improvement.

CASE 19.—E. L. R., aged 26, was admitted to the hospital with a chief complaint of difficulty in walking in the dark and dizziness. The patient was in the southwest Pacific thirty-one months without having any acute illness. Six months before admission to the hospital he had a sudden attack of nausea and vomiting with a severe headache. He also noticed that he had difficulty in walking. The acute symptoms cleared after about one week, but the headaches and imbalance persisted. He noticed that he had difficulty reading while riding in a bus or train. The significant findings follow: The audiograms revealed normal hearing in both ears; the Romberg sign was present; stimulation of both labyrinths by caloric and rotation tests failed to produce nystagmus or dizziness; the Kahn and Wassermann reactions were negative. The patient was given a swimming pool test. While in the water with his eyes closed, he became disoriented and panicky. The course in the hospital was unchanged. The patient still complained of dizziness when discharged. No definite causation could be ascertained in this case.

CASE 20.—J. R. H., an officer pilot, aged 24, on Sept. 29, 1943 found it necessary to bail out of his plane in the China-Burma-India area. He landed safely in a tree in the jungles of Burma, isolated and unable to contact other crew members. He made his way through the jungle subsisting on monkeys, crabs, turtles, insects, berries, bamboo shoots and the like and found himself frequently covered with leeches and ticks, which he constantly picked from his skin. He gradually became weaker but managed to struggle on and finally, after twenty-six days, was found by some natives. He was emaciated and weak and was covered with "running sores and ticks." He had a long series of illnesses and was thought to have typhus complicated by bronchopneumonia. He was also said to have some meningeal signs and a bilateral optic neuritis. On discharge from the general hospital overseas he had almost returned to his normal strength and weight. In April 1944 he became a patient at an Army Air Force regional hospital. The patient noted that he was apt to stagger at night but had no difficulty when there was adequate light, and stated, "There is something wrong with my eyes. When moving, my eyes do not function right." He was able to read without difficulty except on busses, and the slight vibration in such circumstances caused things to blur. Essential physical findings were impairment of hearing, in the right ear 12/15, in the left ear 2/15; no response to stimulation of either labyrinth by the rotation tests; the caloric test produced no response; there was a perforation of the left ear drum; his gait was normal with eyes open, but with eyes closed he staggered considerably; he turned well while walking but tended to be off balance for a couple of steps after turning; there was slight swaying in the Romberg position. To all tests for coordination, rapidly alternating movements and sensations, including the position and passive motion, responses were normal. There was no past pointing. The patient was tested in a swimming pool, and with eyes open he managed to keep in a straight line, but when swimming with eyes closed he swerved to one side or the other. After going 5 feet (152 cm.) he turned almost completely about, lost his balance, went to the bottom, and became oriented again when he opened his eyes. All laboratory tests and roentgenograms gave negative results.

This patient had a bilateral loss of labyrinthine function probably secondary to a central pathologic condition that occurred while he was debilitated with typhus.

The following case is an example of dizziness accompanying hepatitis.

CASE 21.—E. M., a medical officer, gave a history of sudden onset of dizziness nine months prior to admission to this hospital. He also noticed unsteadiness in gait, ringing in his right ear and diminished hearing. The dizziness was aggravated by any quick turn of his head. Examination at that time revealed an enlarged liver and mild jaundice. The significant findings follow: Romberg sign, an unsteady gait, walking with a broad base, absence of nystagmus; a hyperactive labyrinth on the left side and a diminished response on the right side revealed by caloric stimulation; a dip at 2,048 shown by the audiogram. This patient was given a course of histamine and nicotinic acid. He was also given a trial of the Furstenberg regimen without any improvement in his dizziness. Examination eight months later revealed the same findings. There was no change in the dizziness or tinnitus.

It is felt that the same etiologic factor that produced the hepatitis also produced the pathologic process in the vestibular system. Since it is now believed that the cause of hepatitis is a virus infection, virus encephalitis may be present in this case.

The following group of cases are those in which the symptom of dizziness is associated with definite intracranial disease.

CASE 22.—W. C., a woman aged 24, was admitted to the neurosurgical service because of pain behind her left ear and in her neck. The symptoms first appeared about a year before admission. Six months before admission she noticed numbness, tingling and weakness of her left arm and leg. She complained of dizziness which she described as an inability to walk straight. There was true turning vertigo. The significant findings follow: Nystagmus to the right, horizontal and irregular, was present; the audiogram revealed a 20 per cent loss of hearing in the right ear; the caloric stimulation produced nystagmus to the left, slow in onset, of short duration and coarse; stimulation of the left ear produced a fine rotary nystagmus with an onset in thirty seconds and lasting two minutes. Neurologic examination revealed marked ataxia, adiadokokinesis, nuchal rigidity, weakness of the upper extremity, the Romberg sign and absence of abdominal reflexes. Examination of the eyes revealed pronounced papilledema. A diagnosis of high cervical and posterior fossa tumor was made. Operation revealed a meningioma involving the cord and extending into the cisterna magna.

There are many cases of dizziness which follow severe injuries to the head in which there is no involvement of the internal ear by the trauma. In these cases the dizziness is usually described as a vague feeling of unsteadiness which is produced by sudden movements. This lasts for a few seconds. This type of dizziness may remain with the patient for several months after his injury. The following case is an example of this type of vertigo.

CASE 23.—F. J. M., aged 34, was in a plane crash two years before admission to the hospital. He had sustained a concussion of moderate severity. Since that time he had complained of transient dizziness, usually brought on by sudden movements or changes in position. He did not have true rotational vertigo nor tinnitus. He presented these significant findings: an imbalance between the responses of the right and left ears when stimulated with cold water, and a slight dip at 2,048 on the right side, shown by the audiogram. Neurologic examination gave negative results. The diagnosis was postconcussional syndrome.

The cause of the dizziness is unknown in this type of case. It is felt that the disturbance is central.

The following case is one of dizziness developing during meningitis:

CASE 24.—M. W. H., aged 32, was admitted to the hospital complaining of severe pain in her left ear. She was given medication with penicillin. Twenty-four hours later frank signs of meningitis developed and the spinal fluid revealed Pneumococcus type 8. The patient was given sulfadiazine and penicillin intrathecally every twenty-four hours. On this regimen she improved. The spinal fluid became clear. The patient regained consciousness, and her temperature returned to normal. One week after the onset she complained of inability to fix her eyes on an object, dizziness and double vision. Examination revealed marked irregular nystagmus to the right. The nystagmus changed its direction from time to time. The patient also presented transient palsies of her extraocular muscles. The audiogram showed a definite loss of hearing for the upper tones bilaterally. Vestibular tests were not done. The patient's symptoms gradually subsided.

This case represents a vertigo due to encephalitis which probably also involved the oculomotor nuclei.

The following group of cases are those in which the dizziness occurs during pregnancy. The patients showed a vestibular imbalance when tested with caloric stimulation. The exact causation in these cases is not known. The physiologic change that takes place during pregnancy undoubtedly is the basis for the disturbance. This may be metabolic, it may be endocrine, it may be circulatory, or it may be toxic. Each patient must be considered individually. The dizziness usually persists for many months, but disappears after pregnancy. One patient had dizziness which persisted after pregnancy. She was able to produce an attack of vertigo by placing her head in a certain position. During this induced attack, she would have definite nystagmus.

CASE 25.—A woman, aged 24, was seen for the first time in her sixth month of pregnancy. She gave a history of having had a severe attack of vertigo, which she described as a rotation of objects about her. The attack was severe, and she was confined to bed. The vertigo gradually decreased over a three week period. However, the nystagmus persisted. The patient presented these significant findings: a normal audiogram and an imbalance between the right and left labyrinthine responses on caloric stimulation. Following delivery the patient had no further symptoms and nystagmus disappeared.

CASE 26.—I. E., aged 24, complained of a true rotational type of dizziness since the early months of pregnancy. The patient also complained of headaches and a tendency to fall to the right. The following findings were significant: a tendency to stagger after executing an about face to the right, an imbalance between the right and left labyrinths on caloric stimulation and a normal audiogram. Medical examination revealed hypertension and an increase in the nonprotein nitrogen of the blood. A diagnosis of early toxemia of pregnancy was made. The patient was given rest in bed with a low protein diet and sedation for two weeks. This was followed by improvement in her symptoms. Following delivery, the symptoms of dizziness disappeared.

CASE 27.—A. D., aged 34, had a sudden onset of dizziness and tinnitus during her third month of pregnancy. No loss of hearing was noticed. After rest in bed

for two weeks the dizziness became less and the patient was able to get about comfortably, having trouble only when she changed positions rapidly. This sensation of dizziness persisted after delivery, and the patient noticed that when she rotated her head to the left and held it in a certain position she became violently dizzy. The significant findings follow: The patient was able to produce vertigo with rotary nystagmus to the right when she was reclining with her head rotated to the left; vestibular examination revealed an imbalance between the two labyrinths; the audiogram was normal.

This patient had a so-called positional nystagmus. She was seen six months later and was free from dizziness.

SUMMARY AND CONCLUSION

I have attempted to present a representative group of cases in which the patients complained of dizziness and were presented to the otorhinolaryngologic service at the Army Air Force hospital.

These cases were divided into groups as follows: (*a*) a group with true Ménière's disease, (*b*) a group complaining of one severe attack and (*c*) a group with a prolonged history of vertigo due to a pathologic process in the labyrinth, or secondary to some systemic disturbance or due to some intracranial disease.

The importance of a good history, which determines the type of dizziness involved, is stressed.

Complete physical examinations—including medical, neurologic, ophthalmologic, otolaryngologic and dental consultations—are advisable.

It is believed that a slight imbalance in response to caloric tests of both ears is a significant finding.

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HYDROGEN ION CONCENTRATION OF NASAL SECRETION IN SITU IN INFANTS AND IN CHILDREN

With a Comment on p_H Values in Pediatric Nasal Medication

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EVER SINCE the beginning of the present decade, attempts have been made to direct the interest of rhinologists to (1) the relation of the p_H of nasal secretion in situ to applied nasal physiology and (2) to the importance of the p_H factor in the field of nasal medication.[1] Recognition of Fantus'[2] dictum that a hydrogen ion concentration near that normal to the mucous membrane is a matter of even greater importance for applications to the mucous membranes than the matter of isotonicity has provided a firm foundation for rational, physiologic nasal medication.

So far as concerns the p_H values of local medicaments, valid therapeutic conclusions have been drawn in a variety of clinical fields from measurements of the hydrogen ion levels of various secretions found in their original positions on underlying mucous membrane and tissue surfaces. Intranasal treatment by means of rational, physiologic nasal medication requires not only treatment of mucous membrane surfaces (including ciliary action) but treatment of nasal secretion (including the mucous blanket) as well.

In previous communications one of us (N.D.F.) reported that the p_H of nasal secretions in situ in clinically normal nasal passages ranges from

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approximately 5.5 to 6.5 and that these secretions become alkaline during acute rhinitis and acute rhinosinusitis and during the more active phases of allergic rhinitis. Normal nasal secretion (including the mucous blanket) possesses a purposeful acid barrier against infection, for it has been established that acidity as reflected in low p_H values is unfavorable to the growth of pathogenic bacteria,[3] and that nasal secretion possesses an acid composition when receding after allergic attacks.[4] The two phenomena point in corroboration to the significance of normal, slightly acid nasal secretion in situ. Moreover, it has been found that just as emotional changes can cause vasomotor changes in the nasal mucous membrane, so they can produce transient conversions of nasal secretion from a normal, slightly acid to an abnormal, alkaline state in susceptible noses.

In support of the contention that during acute rhinitis, acute rhinosinusitis and the more active stages of allergic rhinitis the employment of a nasal vasoconstrictor which lowers the alkaline nasal p_H to a normal acid level between 5.5 and 6.5 is most desirable has been a recent investigation by Callomon[5]. His study of tissue changes produced in the nasal mucous membranes of normal mice by prolonged local administration of various alkaline and acid solutions containing sulfonamide compounds reaffirms the necessity for utilizing nasal preparations which possess slightly acid p_H values falling within the physiologic range of the nasal p_H of man. Callomon observed that a preparation near the normal, slightly acid physiologic range showed the least irritating effect.

PRESENT INVESTIGATION

Whereas previous measurements of normal and abnormal nasal secretions in situ were taken in adults, young and old, the purpose of the present investigation was twofold: (1) to determine the p_H of nasal secretions in situ in the clinically normal nasal passages of a group of infants and children, and (2) to establish the p_H of nasal secretions in situ as found in infants and children with acute rhinitis, subacute rhinitis and allergic rhinitis. A third objective, namely determination of the effect of hyperventilation and crying on the p_H of nasal secretions in situ in infants and children, will be reported in a subsequent communication.

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TABLE 1.—*Data on p_H of Nasal Secretions in Situ in Clinically Normal Nasal Passages of 44 Infants and Children*

Patient	Age	Sex	Normal Nasal p_H
1. R. L.	9 yr.	M	6.5 6.3 6.1
2. G. L.	11 yr.	M	6.4 6.0 6.0
3. I. G.	12 yr.	F	5.6 5.5 5.4
4. P. P.	9 yr.	M	5.7 5.4 5.6
5. M. H.	2½ yr.	F	5.2 5.1 5.0
6. W. C.	8½ yr.	M	5.7 5.7 5.9
7. L. S.	5 yr.	M	5.1 5.0 5.0
8. R. P.	12 yr.	F	5.9 6.0 6.0
9. R. F.	4½ yr.	M	5.1 5.4 5.4
10. M. R.	10 mo.	F	6.1 6.2 6.4
11. H. K.	2 yr.	M	6.2 6.3 6.5
12. B. S.	3 mo.	M	5.0 5.1 5.4
13. R. K.	4 yr.	F	5.7 5.7 5.7
14. M. S.	9½ yr.	M	5.7 5.7 5.8
15. P. S.	12 yr.	M	5.4 5.3 5.4
16. M. M.	5½ yr.	M	6.1 6.1 6.1
17. N. M.	3 yr.	M	5.7 6.0 6.0
18. B. G.	13½ mo.	F	5.8 6.1 6.1
19. N. L.	2½ mo.	F	5.4 6.2 6.0

TABLE 1.—*Data on* P_H *of Nasal Secretions in Situ in Clinically Normal Nasal Passages of 44 Infants and Children—Continued*

Patient	Age	Sex	Normal Nasal p_H
20. R. R.	3 mo.	M	6.5 6.6 6.7
21. B. K.	5 yr.	M	6.2 6.5 6.4
22. E. S.	12 yr.	F	6.1 6.1 6.2
23. A. B.	9 yr.	F	6.0 6.1 6.0
24. T. W.	4 yr.	M	6.3 6.2 6.2
25. L. W.	12 mo.	M	6.4 6.4 6.5
26. R. B.	4 mo.	M	5.4 5.7 5.6
27. P. R.	7½ yr.	M	6.3 6.5 6.5
28. A. L.	6 mo.	M	6.2 6.7 6.7
29. S. T.	5 wk.	F	5.6 5.9 6.0
30. B. G.	4 yr.	M	5.3 5.4 5.5
31. M. O.	5 yr.	F	5.9 5.6 5.7
32. T. R.	4 yr.	M	5.6 5.7 5.6
33. L. E.	6 yr.	M	6.0 6.0 6.0
34. M. B.	11 mo.	M	5.4 5.5 5.6
35. C. S.	17 mo.	M	6.6 6.2 6.2
36. R. P.	7 yr.	M	5.0 5.2 5.2
37. M. J. C.	4 yr.	F	6.0 6.2 6.2
38. C. R.	4 yr.	M	6.2 6.5 6.7

Patient	Age	Sex	Normal Nasal p_H
39. B. V.	4 mo.	F	6.7 6.7 6.7
40. D. K.	4 yr.	M	5.0 5.1 5.1
41. H. S.	5½ yr.	M	5.9 6.0 6.3
42. M. W.	5 mo.	M	6.5 6.7 6.7
43. B. Z.	12 mo.	M	6.0 6.6 6.6
44. R. L. S.	3 wk.	F	5.9 5.9 6.0

While all three objectives involved an investigation of 100 infants and children, the present report deals with 61 infants and children seen in the private practice of one of us (M.A.P.) whose ages ranged from 3 weeks to 12 years. The 61 subjects consisted of 18 infants under 2 years of age and 43 children 12 years of age or under and included 23 females and 38 males. In this study specially constructed silver—silver chloride glass electrodes were employed in conjunction with the Coleman electrometer. Because of the inherent difficulty of carrying on nasal p_H readings over prolonged periods of time in infants and very young children, it was decided initially to record three consecutive readings taken at one-half minute intervals.

The p_H of nasal secretions in situ in clinically normal nasal passages of a group of 44 infants and children was found to range from 5 to 6.7. In a group of 17 infants and children with abnormal nasal findings, nasal p_H ranged from 7 to 8 in acute rhinitis, from 6.7 to 7.2 in subacute and subsiding rhinitis and from 7.2 to 7.3 in active allergic rhinitis. Subsiding allergic rhinitis revealed a nasal p_H of 6.7 (figs. 1 and 2).

COMMENT AND SUMMARY

The p_H of nasal secretions in situ in the clinically normal nasal passages of 44 infants and children was found to range from 5 to 6.7. This p_H range parallels the p_H of nasal secretions in situ in clinically normal adult nasal passages (5.5 to 6.5). In a group of 17 infants and children with abnormal nasal findings, nasal p_H ranged from 7 to 8 in acute rhinitis, from 6.7 to 7.2 in subacute and subsiding rhinitis and from 7.2 to 7.3 in active allergic rhinitis. This p_H range also parallels the abnormal alkaline p_H of nasal secretions in situ in adults during an attack of

CHART 2.—*Data on Nasal p_H in Acute Rhinitis, Subacute Rhinitis and Allergic Rhinitis*

Patient	Age	Sex	Nasal State	Nasal pH
45. C. G.	9½ yr.	F	Subacute rhinitis	6.8 6.9 6.8
46. L. H.	3 yr.	M	Subacute rhinitis	6.9 6.8 7.0
47. G. C.	2½ yr.	M	Acute rhinitis	7.0 7.0 7.1
48. B. M.	8 mo.	M	Subacute rhinitis	6.7 6.9 6.9
49. M. T.	5 yr.	M	Acute rhinitis	7.2 7.2 7.4
50. B. J.	1½ yr.	F	Acute rhinitis	7.9 7.7 7.6
51. S. B.	5 yr.	F	Subsiding rhinitis	6.8 6.7 6.7
52. R. L.	2 yr.	F	Subacute rhinitis (crying)	7.7 7.9 7.9
53. R. L. P.	10 yr.	M	Subacute rhinitis	7.2 7.2 6.8
54. G. E.	8 yr.	F	Subacute rhinitis	6.9 6.9 7.0
55. A. P.	2½ yr.	M	Subsiding rhinitis	6.8 6.7 6.7
56. N. C.	9 yr.	F	Subsiding allergic rhinitis	6.7 6.7 6.7
57. M. B.	5 yr.	F	Subsiding rhinitis	6.8 7.1 7.0
58. R. M.	10 yr.	M	Allergic rhinitis	7.3 7.2 7.2
59. C. K.	17 mo.	F	Acute rhinitis (crying; teething)	7.7 7.8 8.0
60. J. C.	6 yr.	F	Subsiding rhinitis	6.7 6.8 6.8
61. A. S.	11 yr.	M	Acute rhinitis	7.6 7.4 7.6

acute rhinitis, acute rhinosinusitis and during the more active phases of allergic rhinitis.

As in the case of adult intranasal treatment, pediatric intranasal treatment by means of rational, physiologic nasal medication requires not only treatment of mucous membrane surfaces (including ciliary action) but treatment of nasal secretion (including the mucous blanket) as well. Normal nasal secretion (including the mucous blanket) possesses a purposeful acid barrier against infection, for it has been established that acidity as reflected in low p_H values is unfavorable to the growth of pathogenic bacteria and that nasal secretion possesses an acid composition when receding after allergic attacks. Corroborative evidence pointing to the importance of slightly acid sulfonamide and penicillin[6] nasal medicaments demonstrates that a preparation with a p_H value near the normal, slightly acid physiologic range of nasal secretion in man has the least irritating effect.

In view of the significant relationship of the p_H of nasal secretion in situ to applied nasal physiology, bacteriology and nasal histopathology, it is proposed that pediatric nasal medication for use in the nasal passages of infants and children be so constituted as to possess a p_H value falling within the 5 to 6.7 range, i.e., a slightly acid, physiologic p_H value approximating that of normal pediatric nasal secretions.

185 North Wabash Avenue

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LOOSE DENTURES AS ESOPHAGEAL PROBLEMS

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MANY AN ARTIFICIAL denture is a menace to its wearer. Suddenly a functional and cosmetic oral asset may become an esophageal liability. Dentists know how common a mishap it is for people to swallow small or broken loose dentures. Many dentists and some physicians do not appreciate the danger to the patient when a denture fails to pass through and instead lodges in the esophagus. The growing use of radiolucent acrylic compounds for the construction of dentures makes the roentgenologist's job of diagnosis increasingly more difficult.

Clinical cases of deficiencies in artificial dentures have been chosen to present from the standpoint of the laryngologist. These cases suggest that the popular temporary denture made to supply upper central teeth should be abandoned by the dental profession. The loose removable bridge should not be employed, as it jeopardizes its wearer. The dangers of the broken upper complete denture need greater publicity. While it is incumbent on the laryngologist to point out to the dental profession inadequacies in dental reconstructions, the troubles that result therefrom bring up practical points that need to be stressed to general physicians, to radiologists and to laryngologists.

First in importance is the temporary denture used to supply a missing front tooth in the upper jaw. For children and adults who have lost one, two or three teeth in this reigon, a quick, inexpensive and pleasing reconstruction is offered by the dentist. One or more artificial teeth are attached to an acrylic plate, which extends back a short distance over the hard palate. Small projections extend into the interdental spaces between the two, three or four teeth adjacent to the gap of the missing tooth or teeth. A slight arch to the plate permits enough spring or resilience to hold the plate firmly in place for a time (fig. 1). Wear of the plate and widening of the arch through pressure or growth cause these dentures to loosen. My secretary's sister, aged 13, had such a reconstruction supplying an upper left central incisor. She liked to move this artificial tooth up and down with her tongue to amuse her friends.

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A movable denture such as this is, to my mind, a great hazard to the patient. Three cases, from a small series of 5, make this point clear.

REPORT OF A CASE

CASE 1.—A. R. N., a 22 year old white man, was admitted to the Massachusetts Eye and Ear Infirmary in the late afternoon of May 16, 1942 because of a denture in his esophagus. The morning before he awoke choking at attempts to swallow. He immediately realized that while asleep he had swallowed a partial denture, which he had received three or four weeks previously to supply him with a false right upper central and a lateral incisor tooth. Because of persistent pain on swallowing he was taken to a nearby hospital where, as he described it, after having his throat frozen and being given the needle, a tube was passed down through his mouth. This unsuccessful procedure took an hour and a half. That evening at another hospital, with the patient under local anesthesia, another endoscopist was unable to locate the foreign body with a 9 mm., 45 cm. Jackson esophagoscope. This passed easily to the cardiac orifice. The operator thought the denture had been pushed into the stomach, but roentgenograms showed the foreign body to be in the same position. Accordingly the next morn-

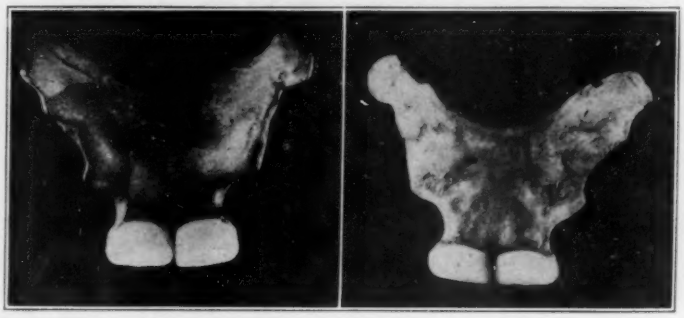

Fig. 1.—Temporary denture, worn and ill fitting, radiolucent; it was removed from the middle third of the esophagus on May 13, 1943.

ing, under fluroscopic guidance, the patient was examined with the esophagoscope for the third time, under local anesthesia. A tooth was located after considerable hunting. A satisfactory grasp of the tooth could not be obtained. Edema of the mucosa prevented a view or grasp of the base plate. Prior to operation a dentist had made a cast of the upper teeth and reconstructed a partial plate to serve as a guide. Hoping that relaxation under ether would solve this difficult case, a fourth operation was performed in the afternoon. With ether administered by nasal tube used as an anesthetic, the operator located the foreign body in an edematous traumatized esophagus, only to have the patient stop breathing. Artificial respiration restored breathing, but the anesthetist advised that operation be abandoned. The patient, recovering from the anesthesia, was brought to the infirmary by ambulance. Roentgenograms, dental reconstruction and a graphic description by the operator accompanied the patient.

Roentgen films on admission (fig. 2) demonstrated the denture to be in about the same position as it was at the start of manipulations. The composition of the denture was radiolucent. Two gold pins holding each tooth in place could be clearly seen. The other parts of the denture were not well outlined.

Physical examination revealed a well developed, well nourished white man, unconscious, with the odor of ether on his breath. He was well hydrated. The heart was normal. The blood pressure was 120 systolic and 80 diastolic. The lungs were resonant with a few medium moist rales throughout both sides of the chest. The abdomen and extremities were normal. The nasal mucosa was congested and some mucopurulent secretion was present in each airway. Several

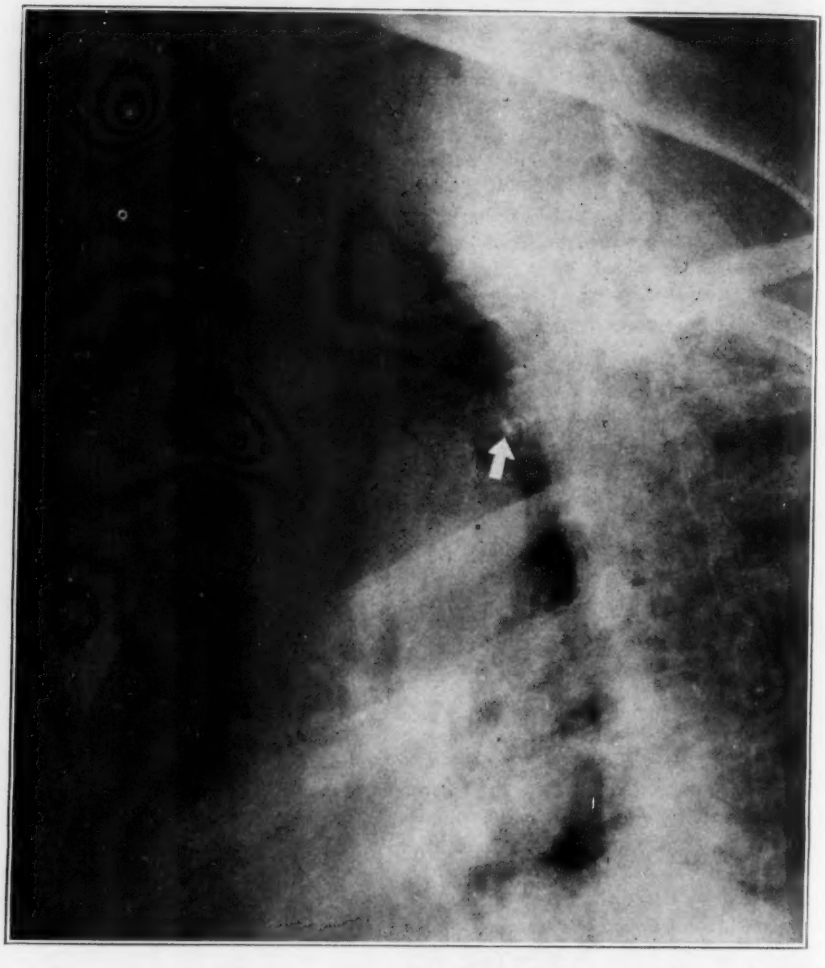

Fig. 2.—Lateral roentgenogram of the chest showing radiolucent denture with two teeth in the upper third of the esophagus.

teeth had been extracted; the remaining ones were in good condition. There was an abrasion of the left tonsil. The pharyngeal mucosa was reddened. There was some postnasal secretion. There were edema and abrasion of both arytenoids. Otherwise the examination gave negative results.

The temperature rose to 103 F. rectally in spite of 2 Gm. of sufadiazine given intravenously in fluids. The white blood count was 14,700 and the urine was essentially normal. Under sulfadiazine therapy a blood level of 9.8 mg. per hun-

dred cubic centimeters was achieved. The temperature stayed elevated at about 102 F. After forty-eight hours of fluids and chemotherapy operation was performed.

Under ether anesthesia examination of the hypopharynx showed the left piriform sinus to be traumatized. The left arytenoid was swollen and covered with thick white eschar. The right piriform sinus was clear, although the right arytenoid was swollen. By way of the right piriform sinus a 12 inch (30.48 cm.) Mosher esophagoscope was inserted into the esophagus. Just below the cricopharyngeus muscle the esophageal walls were edematous, greatly narrowing the lumen. The denture was seen and the surrounding esophageal surface noted to be edematous, with multiple excoriations covered with thick white scabs. The deepest laceration was on the posterior wall just above the foreign body. The pink denture plate was grasped and the foreign body found to be firmly impacted. About a half inch (1.27 cm.) of the dental plate broke off in an attempt at rotation. This fragment was removed through the esophagoscope. The esophagoscope was inserted through the esophageal lumen close to the foreign body. By repeated attempts at twisting and turning, the foreign body was gradually loosened from the edematous mucosa. It was then removed as a trailing foreign body. Reinsertion of the scope demonstrated small fresh excoriations where the foreign body had been lodged. There was no bleeding. The foreign body was a temporary removable denture carrying two teeth.

The following day the patient's temperature became normal. Except for moderate pain on swallowing, he had no complaints. The next day his white blood cell count was 4,300 with 74 per cent polymorphonuclear leukocytes. The blood sulfadiazine level was 9.8 mg. per hundred cubic centimeters. The pulse and respirations were normal. By special request the patient was discharged from the infirmary to convalesce in the hospital from which he had been referred. He was to continue the sulfadiazine therapy for ten days and to be checked by roentgenograms. Unfortunately, in another forty-eight hours he was accidentally discharged as well by a physician who was not aware of the patient's history. The latter physician, finding the patient without complaints, said further hospitalization was not indicated. On the fifth postoperative day, while riding in a bus, the patient suddenly vomited bright red blood, collapsed, and was taken to the Boston City Hospital. There he died before any treatment could be given.

Autopsy demonstrated lacerations of the esophageal wall, all healing nicely save one. This contained clotted blood. When the blood was gently removed, a fistula could be traced to the left carotid artery, which was eroded. The stomach was full of blood. Death was due to hemorrhage from the eroded left carotid artery.

It is unfortunate that this patient was permitted to leave the infirmary. It is doubly unfortunate that subsequent hospitalization was accidentally interrupted. Perhaps the outcome was inevitable. In view of the fact that no bright red blood was apparent at my operation, perforation may not have occurred at that time, although considerable traction force was used. Certainly the four previous operations were contributory. Perhaps the greatest regret should be that the patient was not sent originally to the infirmary, where an adequate armamentarium was available. The case illustrates the potential danger of this type of foreign body in the esophagus.

Case 2.—A 29 year old white man, was admitted to the Massachusetts Eye and Ear Infirmary on Feb. 28, 1946 because of dysphagia and inability to swallow solid food. After having served his country without a left

upper central incisor tooth, the patient was fortunate, he felt, to obtain just prior to discharge from the army, a partial denture. The central incisor fitted in place well and the denture plate extended beyond the first bicuspid tooth on each side. After wearing the appliance for two years, one day the patient yawned, breathed inwardly, and swallowed the denture before he could help himself. He immediately went to his own physician because of pain in the midportion of his chest. His doctor assured him that because a half hour had elapsed and he had

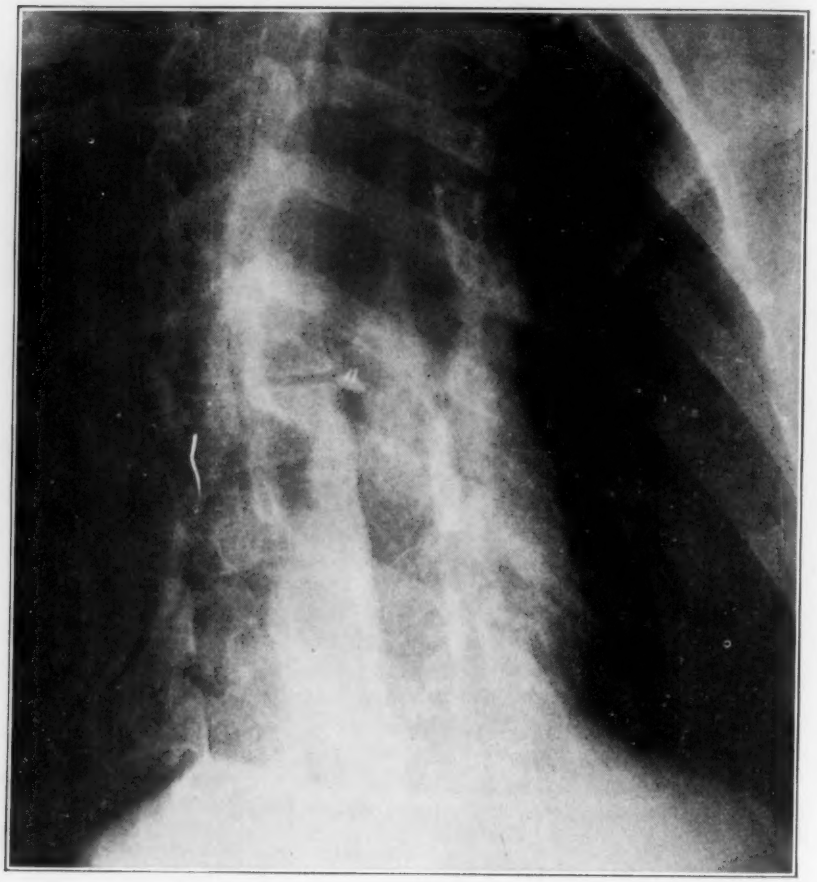

Fig. 3.—Lateral roentgenogram of the chest showing radiolucent denture with one tooth in the middle third of the esophagus.

not choked to death, all was well and he would pass the denture. The following day because of persisting discomfort the patient again went to his physician. This time he was sent to have roentgenograms made. These were reported as normal.

Six days later the patient again returned to his physician because it still hurt when he swallowed. The doctor said: "The roentgenograms are normal; you must sweat this out; it will pass." Three weeks later the patient, now unable to eat solid food and having considerable discomfort in taking liquids, went to another doctor. He ordered roentgenograms. These, too, were reported as not showing

a foreign body. The doctor said: "This is beyond me," and referred the patient to the infirmary. Roentgen study demonstrated two small pins such as are used to hold a tooth to a denture plate. With barium meal and fluroscopy, Dr. A. S. MacMillan outlined the denture. His report was: "Dental plate with tooth in the middle third of the esophagus. Tooth down, one end of plate buried in edematous tissue on the anterior wall; upper end should be relatively free" (fig. 3). Physical examination, urinalysis and examinations of the blood all gave normal results.

The following day with the patient under intratracheal-ether anesthesia, the full lumen medium length Mosher esophagoscope was inserted. The denture was found at the junction of the middle and lower thirds of the esophagus. The esophageal walls were edematous. On the right side the mucosa was badly abraided, with considerable exuberant granulation tissue. When the denture was gently pried loose from this area there was a moderate amount of bleeding. The denture was then easily removed as a trailing foreign body (fig. 4). The esophago-

Fig. 4.—A temporary denture.

scope was reintroduced and the site of lodgment of the foreign body carefully inspected. On the right esophageal wall there was an area three quarters of an inch (1.91 cm.) in diameter, covered with granulations which bled easily. This was a deep ulceration. Elsewhere the mucosa was intact.

The patient was given fluids intravenously for the next two days. He received 5 Gm. of sulfadiazine intravenously each day. Throughout the hospital stay 200,000 units of penicillin per day was given. Temperature, pulse rate and respirations remained normal. Fluoroscopic examination of the esophagus was made every few days. Four days after operation Dr. MacMillan noted "some spasm and filling defect in the middle third." Ten days after operation, except for a small penetrating defect at the site of the extracted dental plate, the esophagus appeared normal by fluoroscopy (fig. 5). The patient was symptom free. In fact, from the first operative day onward he had no pain or discomfort. He was therefore discharged home on the tenth postoperative day.

Follow-up roentgenograms two weeks later showed only slight roughness of the esophageal wall at the site of the extracted foreign body.

This case emphasizes the need for good roentgenograms. The denture material, an acrylic compound, is not radiopaque. The tooth itself, also made of an acrylic compound, is not well seen in many roentgen films. The two gold pins used to held the tooth to the plate are radiopaque. There is no good excuse for a roentgenologist to miss them. Improper exposure of the film and carelessness in interpretation may imperil a patient's life. Certainly the family doctor must not be judged too harshly. The second physician, faced with signs of esophageal obstruction, properly ignored a roentgen finding of "esophagus nor-

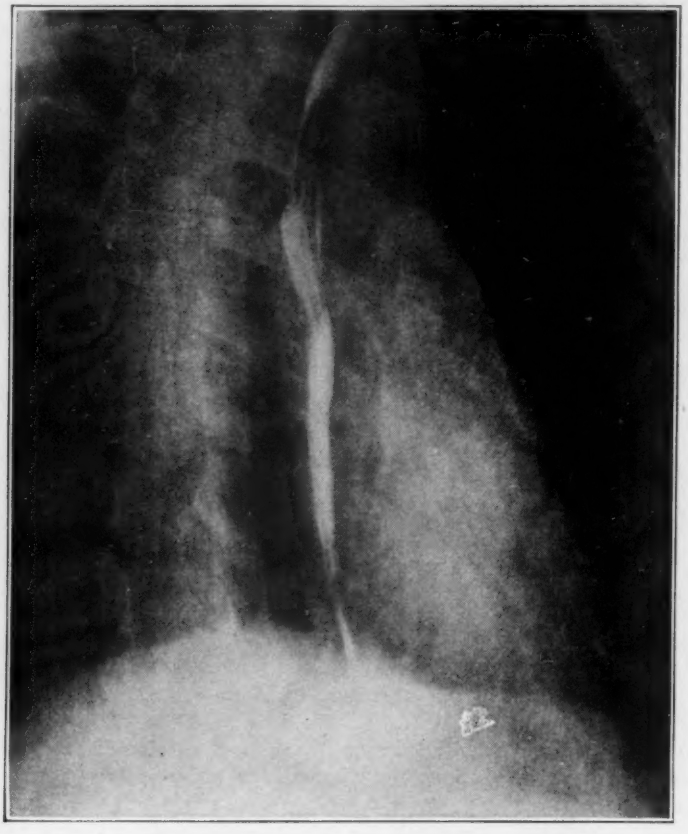

Fig. 5.—Roentgenogram taken ten days after operation.

mal." In time this foreign body would have perforated the esophagus. Perhaps it is owing to the chemotherapy given that mediastinitis did not develop after operative removal. The margin of safety was thin.

CASE 3.—J. M., a 49 year old white man, entered the Massachusetts Eye and Ear Infirmary on March 18, 1946 because of a partial denture in the lower part of his esophagus. Nine and a half hours earlier he awoke sneezing and coughing. This loosened his partial denture carrying an upper central incisor tooth. The denture slipped down his throat, stuck for a bit and then went farther down and stuck again. He went to a local hospital, where a thorough examination was made. Roentgenograms disclosed a denture at the lower end of his

esophagus (fig. 6). Adequate instruments for removal not being available, the patient was transferred to the infirmary.

On admission the patient, who had had nothing to eat that day, did not vomit, cough or choke. He complained of spasmodic pain about every thirty seconds located in the midline at the level of the xiphoid process. Examination revealed a plethoric man in but little distress. He had an apical systolic and diastolic murmur with a systolic thrill. There was an aortic grade 3 systolic murmur. The blood pressure was 170 systolic and 80 diastolic. The liver was

Fig. 6.—Spot film showing radiolucent denture with one tooth in the lower third of the esophagus.

palpable for two fingerbreadths below the right costal margin. Otherwise the physical findings were unimportant. The compensated rheumatic heart with mitral stenosis and regurgitation was deemed suitable for anesthesia. The urine was normal.

Fourteen hours after his accident the patient was operated on under intratracheally administered nitrous oxide, oxygen and ether anesthesia. The long full lumen Mosher esophagoscope was easily passed. The foreign body was visualized. There were a few small abrasions of the esophageal mucosa on the medial wall

2 inches (5.08 cm.) above the foreign body. Except for slight edema of the mucosa at the site of the foreign body, the esophagus seemed normal. The denture was grasped and freed from the mucosa. One end of the denture was pulled into the esophagoscope and, dangling from the forceps, the denture was removed as a trailing foreign body (fig. 7). There was almost no bleeding. The esophagus was inspected again. No other signs of trauma were noted.

Convalescence was uneventful. During the hospital stay, 200,000 units of penicillin was given daily. Temperature, pulse and respirations were normal. The patient had no discomfort postoperatively. Fluoroscopy revealed a normal esophagus. Three days after operation the patient was discharged as well.

The case demonstrates the benefits of prompt diagnosis and treatment. Operation was easy. Convalescence was rapid. Probably chemotherapy was not necessary but it was given prophylactically. Perhaps the most important point is that the exact roentgen diagnosis was made in another hospital which, appreciating the need for an adequate armamentarium and lacking such, referred him to the infirmary.

Fig. 7.—Temporary denture.

The temporary partial denture described in the first 3 cases is not a good type of dental reconstruction. It lulls its wearer into the belief that it is a permanent denture. With continued wear it becomes loose and daily is more easily lost into the esophagus. Many a denture passes through the esophagus uneventfully. When such a dental reconstruction lodges, the roentgenologist must be wary. The newest dentures are being made of radiolucent teeth fused to a radiolucent plate without the need for any pins. On the regular roentgen film there will be nothing to attract the eye of a roentgenologist. Unless he is forewarned that special study is indicated, inevitably there will be negative reports. The endoscopist of course will employ the esophagoscope on the basis of symptoms even though the roentgenograms be reported normal. However, a normal roentgenogram may mislead some general practitioners, as in case 2. Should not the laryngologist make a plea to the dental profession that a radiopaque substance outlining the denture be incorporated at the time of construction?

The removable dental bridge is another type of dental reconstruction that is dangerous to its wearer.

CASE 4.—D. R., a 46 year old white man, was admitted to the Massachusetts Eye and Ear Infirmary on Jan. 17, 1946 because of a dental bridge in his esophagus. For five years he had worn a bridge in his upper jaw. A bar across the roof of his mouth held a false second bicuspid and a first molar tooth in place on each side. The device broke and was taken to a dental repair man. The patient was advised that two separate bridges, one for each side, would be better. The bar was done away with. A set of clasps was placed anteriorly and posteriorly on each pair of teeth. The clasps were fitted to the adjacent teeth. The patient asked the repair man if such a dental construction was safe and would stay in place. Clasps, he was assured, were absolutely safe. Yet in five

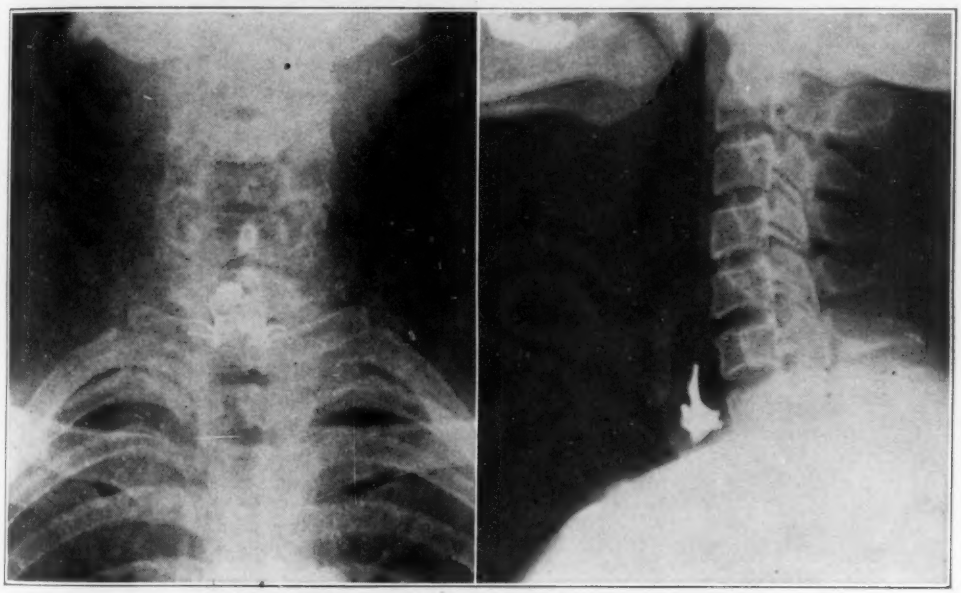

Fig. 8.—Roentgenograms of the neck showing a removable bridge in the upper third of the esophagus.

days' time, while he was eating a piece of toast, a pair of the teeth with clasps on each end disappeared from their proper position. The patient experienced severe pain in the lower part of his neck. He became nauseated and vomited blood-tinged mucoid secretion. Because of persistent pain and tenderness low in the neck he came to the infirmary.

Roentgenograms demonstrated a removable bridge containing two crowns in the upper end of the esophagus. The clasps appeared to be embedded in the esophageal wall, deeper on the right side than on the left (fig. 8).

Physical examination showed the pharynx to be congested. There was some blood-stained mucoid secretion in the hypopharynx. There was tenderness in the neck to pressure and to manipulation just above the level of the clavicles. The heart and lungs were normal. The blood pressure was 200 systolic and 130 diastolic.

Three and a half hours after ingestion of the dental bridge operation was performed with the patient under nitrous oxide, oxygen and ether intratracheal anesthesia. The short full lumen Mosher esophagoscope was inserted with difficulty because of edema of the esophageal walls and rigidity of the neck. About 2 inches below the mouth of the esophagus the foreign body was found with its clasps embedded in edematous mucosa. The foreign body was firmly impacted. The clasps on the right were more deeply embedded than those on the left. It was possible therefore to grasp the clasps on the left and free them from the mucosa. The foreign body was then rotated upward so that the clasps were up and down

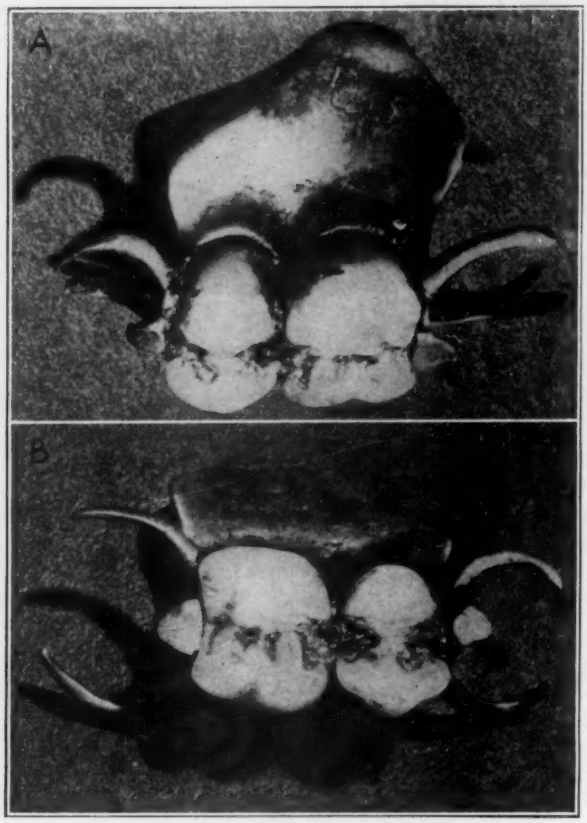

Fig. 9.—Removable bridge.

in relation to the esophagus. The foreign body was large and difficult to hold suitably with forceps. It was removed with some effort through the edematous esophageal walls as a dangling foreign body (fig. 9). Bleeding was moderate in amount. It was obvious that there were deep lacerations of the esophagus and probably perforations on the right.

For the next five days the patient received nothing by mouth. He was given saline solution with dextrose intravenously and daily received 5 Gm. of sodium sulfadiazine. The dose of penicillin, 200,000 units per day, was decreased to 100,000 units daily on the fourth day and continued throughout the hospital

stay. The patient complained of pain over the sternum and in the back at the same level for three days. His white count rose to 19,800. Temperature, pulse and respirations were normal. A roentgenogram on the first postoperative day showed the chest to be clear. There was considerable swelling, with air in the soft tissues at the site of the extracted foreign body (fig. 10*A*). On the fourth postoperative day the roentgenogram still showed some swelling of the soft tissue; the air had been absorbed (fig. 10*B*). Nine days after operations, symptom free, the patient was discharged home. A follow-up roentgenogram a month later demonstrated a normal esophagus, without periesophageal swelling.

This case was serious. Although the patient came to the hospital promptly, esophageal perforation and developement of mediastinitis occurred. The foreign body was of unusual shape. It was a difficult problem for the esophagoscopist to solve. The patient's satisfactory convalescence probably was due to chemotherapy. Only a few years ago immediate external incision and drainage was the operation of choice when esophageal perforation was evident. Chemotherapy makes this heroic procedure seldom necessary. But all of this patient's trouble goes back to the dental mechanic who instead of repairing a satisfactory denture made two loose removable bridges. A removable bridge, one that is easily removable, endangers its wearer. It is up to the laryngologist who sees cases such as this to educate members of the dental profession. Certainly the laryngologist has the opportunity to check on considerable bridgework.

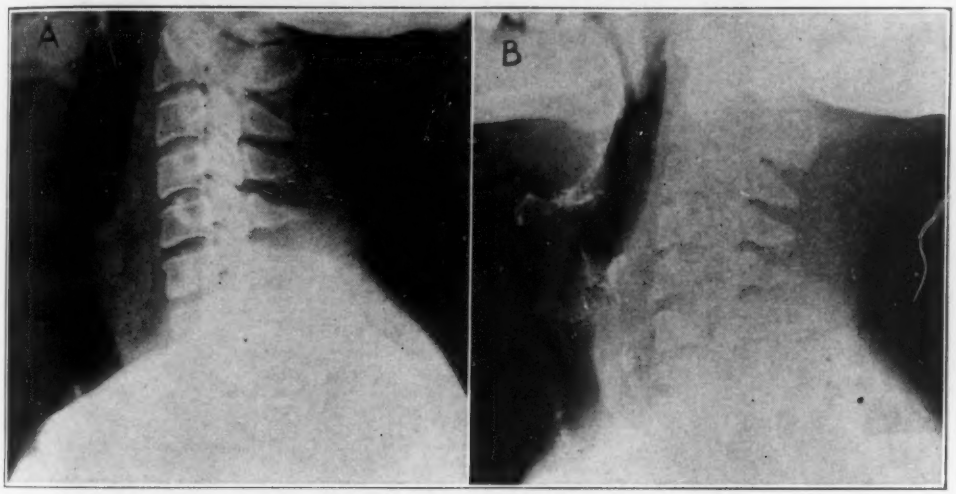

Fig. 10.—*A*, lateral roentgenogram of the neck taken twenty-four hours after operation, showing retropharyngeal swelling and air at the site of the foreign body; *B*, four days postoperatively, with barium outlining the esophagus and showing air absorbed.

The last 3 cases demonstrate the attitude of the average person toward a broken artificial denture.

CASE 5.—R. McI., a 45 year old white man, was admitted on July 8, 1944 to the Massachusetts Eye and Ear Infirmary because he had swallowed a broken upper dental plate. Ten or twelve months previously this salesman had broken his upper plate. He discovered a dental powder that held the two broken parts of the plate in place satisfactorily. Consequently he neglected to have a new plate made. Arriving in Boston on the train early one morning he found his supply of powder exhausted. He slipped his teeth in place without the powder and went to breakfast. At breakfast he inadvertently swallowed the larger half of the dental plate. Discomfort was not great. His family physician examined him and advised that everything would be all right. However, during the day the patient became increasingly aware that everything was not all

Fig. 11.—Lateral roentgenogram of the neck showing radiopaque denture in the upper third of the esophagus.

right. By nightfall pain on swallowing saliva and inability to swallow solids or liquids brought him to the infirmary.

The results of the physical examination were not remarkable save for exquisite tenderness in the suprasternal notch. A roentgenogram demonstrated a large dental plate in the upper third of the esophagus (fig. 11). That evening with the patient under ether anesthesia the short full lumen Mosher esophagoscope was inserted. The foreign body was found easily movable. It was grasped and removed as a dangling foreign body. There was no bleeding. This large dental plate carried five front teeth. Yet there was little trauma observed in the esophagus.

The patient's convalescence was uneventful. Sulfadiazine was given to achieve a blood level of 7.2 mg. per hundred cubic centimeters. There was no fever. The patient had no complaints. A roentgenogram of the esophagus on the

third postoperative day was normal except for slight periesophageal swelling, and the patient was discharged. A week later he was seen and found to be symptom free.

CASE 6.—B. M., a 32 year old white unmarried woman, was admitted to the Massachusetts Eye and Ear Infirmary on May 22, 1944 because she had swallowed a piece of a dental plate. As in the previous case, this woman had for appearance sake worn a broken portion of an upper plate carrying two anterior teeth. Two hours before admission while eating supper she swallowed the denture. There were no complaints other than an uncomfortable sensation felt in the midline just between her breasts.

Physical examination gave negative results. The roentgenogram demonstrated a dental plate in the esophagus just above the aortic arch (fig. 12).

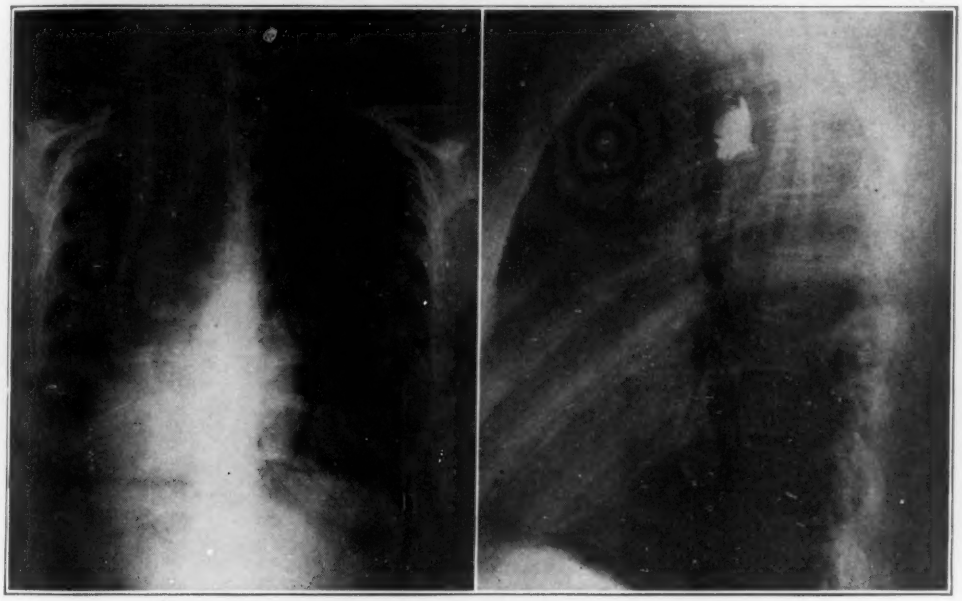

Fig. 12.—Posteroanterior and lateral roentgenograms of chest showing radiopaque denture in the middle third of the esophagus.

Four hours after ingestion the foreign body was removed with the patient under ether anesthesia. A full lumen Mosher esophagoscope was passed and the denture found to be relatively free in the esophagus. It was grasped and removed as a trailing foreign body with little difficulty. The esophagoscope was reintroduced and the walls of the esophagus inspected. Save for a slight abrasion in the mucosa and slight edema at the site of the denture the esophagus was normal. A slight amount of bleeding occurred at removal.

Convalescence was normal. Sulfadiazine was given prophylactically for two days. Dr. A. S. MacMillan's report on the roentgen examination on the third postoperative day was "normal esophagus, no obstruction to the passage of barium, no spasm." The next day the patient was discharged.

CASE 7.—S. E. R., a 34 year old diabetic man, entered the Massachusetts Eye and Ear Infirmary because of a denture in his esophagus. For cos-

metic reasons this man wore the broken half of his upper dental plate which supported four teeth. Eight hours before admission he accidentally swallowed the denture. Because of pain in spasms, referred to the midline, at the region of the xiphoid process, he went to his local hospital. Roentgenograms made there demonstrated a foreign body. He was referred to the infirmary. The roentgenograms showed the dental plate in the upper portion of the lower third of the esophagus. The teeth were turned upward; there was a rough hooklike clasp at the lower end of the plate, which was 5 cm. in length (fig. 13).

The patient's history of diabetes was of three or four months' duration and had been controlled with diet. Of late he had not observed this diet. Urinalysis revealed sugar (3+) and acetone (1+).

For the past week he had had a cold and a slight cough. Physical examination showed the nasal and pharyngeal mucosa to be congested. The nasal secretion was mucoid. Moist rales were heard at the base of the right lung and

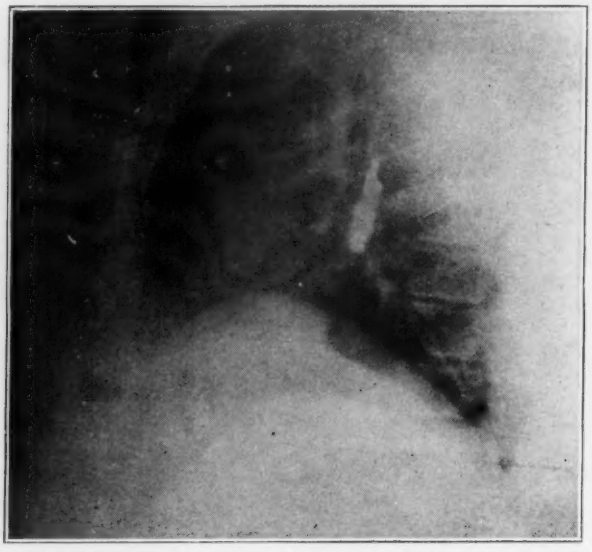

Fig. 13.—Lateral roentgenogram of the chest showing radiopaque denture in the lower third of the esophagus.

wheezes throughout the chest. There was no dulness to percussion. The pulmonary fields were clear in the roentgenograms. The remainder of the examination did not show any abnormality.

Bcause of the size and the type of the foreign body immediate operation with the patient under ether anesthesia seemed indicated. Ether was selected to provide maximum relaxation. A long full lumen Mosher esophagoscope was easily passed down to the foreign body. There was little edema of the esophageal walls. The denture was grasped and freed from the mucosa. It was easily removed as a trailing foreign body (fig. 14). The esophageal walls were inspected again with the esophagoscope. No abrasion or other evidence of trauma was seen.

The patient's convalescence was only slightly prolonged. The medical service cared for the diabetes. A blood sugar of 204 mg. per hundred cubic centimeters at the time of operation was reduced to the normal amount. Insulin dosage was controlled by tests for sugar in the urine. A suitable diet was given, and the patient is still reporting periodically to the diabetic outpatient department.

Roentogen examination on the second postoperative day showed partial atelectasis of the right lower lobe posteriorly. Two days later this was reported clearing. Physical signs in the chest disappeared on the third day. Throughout the hospital stay 200,000 units of penicillin a day were given. Temperature, pulse and respirations were normal. Seven days after operation the patient was discharged, symptom free, to the care of the diabetic clinic.

The last 3 cases are a commentary on the lack of knowledge of the layman. These 3 persons, like many others, did not appreciate the danger of ingestion of a dental plate. Is it not the duty of the laryngologist to educate the lay public to such dangers? A new dental plate in each case would have prevented an operation, hospitalization, etc. Fortunately in each case the patient came quickly to the hospital. Diagnosis

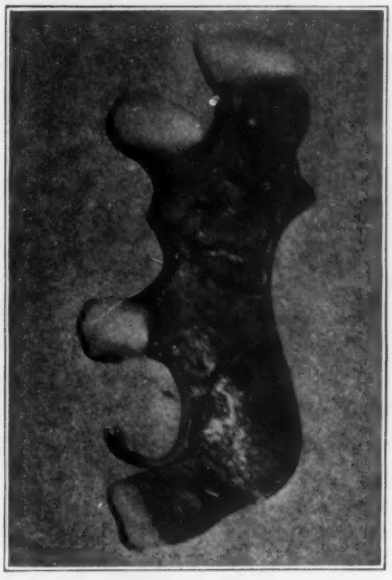

Fig. 14.—Radiopaque denture.

by the roentgenologist was easy because the dentures were of the old type, made of radiopaque material. The endoscopists' job was reasonably easy although the foreign bodies were large. With chemotherapy available general anesthesia can be more safely used. And under ether anesthesia maximum relaxation permits the insertion of a maximum-sized esophagoscope. This gives better working space and permits better removal of foreign bodies.

As for the complete upper denture, dental efforts at improvement seem chiefly directed toward making indestructible plates. An unbreakable plate, with teeth similarly unbreakable and unattachable, is of course a goal to be desired. Perhaps, however, insufficient thought has been given to its design. It may well be that the present type of complete upper denture is the best possible. But endoscopists note that of adults

who have inadvertently swallowed foreign bodies and had them stick in the esophagus, 85 to 90 per cent have an upper false plate. The patient with an upper denture takes a foreign substance into his mouth and, not feeling it between tongue and hard palate, gets it back into his throat, feeling it only as he accidentally swallows. Abnormal substances one normally feels between the tongue and hard palate and, thus warned, removes them from the mouth. Any person with the sensation of his hard palate obliterated by an artificial denture has therefore 50 per cent less chance of feeling a foreign body. He must be twice as careful with what he eats. Sometimes, in addition, the wearer of a denture has trouble with chewing, which further favors the swallowing of large boluses. The dentist who provides a denture has a duty to his patient. He must warn of the necessity for redoubled care in eating to avoid ingestion of foreign bodies. Cannot the dental profession redesign the upper denture? A window over the hard palate would restore the ability of the patient to feel with tongue and palate. With the various new metals and plastics cannot sufficient support and suction be achieved even though the greatest source of suction be removed?

CONCLUSIONS

1. Early diagnosis of a denture lodged in the esophagus shortens the postoperative convalescence. It must be emphasized to the general practitioners and to laymen that not all dental plates pass through the esophagus without harm.

2. Roentgen diagnosis of a radiolucent denture is difficult. When no radiopaque pins are used to hold the tooth to the denture roentgen diagnosis will be missed sometimes. The endoscopist must be consulted on the basis for the patient's symptoms.

3. For the removal of large dentures, ether is the anesthetic of choice. It provides maximum relaxation, permitting maximum working space.

4. Without an adequate armamentarium extraction should not be attempted. More harm than good may result from only slight manipulation of the foreign body.

5. Chemotherapy with sulfanomide compounds and penicillin has done away with the necessity for immediate external incision and drainage for esophageal perforations. Often surgical treatment is not necessary.

6. The temporary denture supplying the upper central incisor teeth is a menace to its owner. Its danger should be brought home to the dental profession.

7. Loose removable bridges are equally bad.

8. The risk of wearing a broken denture needs greater publicity.

9. The complete upper denture should be redesigned.

PSYCHOSOMATIC COMPONENTS OF DISEASE IN OTOLARYNGOLOGY

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ARMY LIFE has given physicians an opportunity to treat patients under unusual circumstances. Separation from home, regimentation, exhaustion and modern total global combat were some factors. These when combined with the background of a prevalent pacifistic attitude, which resulted from the disappointments of World War I, have produced stressful psychologic situations unequaled in previous struggles. As a flight surgeon, I was afforded opportunities to observe an Army group which experienced all these disturbances and, in addition, incurred the stress of flying. These stresses contributed to the formation of many complaints which originated on a psychic basis. The frequency with which symptoms referable to the ear, nose and throat were associated with such psychosomatic phenomena was related to the fact that these symptoms often occurred as a technic of avoiding the dangers attendant on flying. If treatment was given with understanding, it was usually successful, and the men continued with their duties. A large number of such cases with otolaryngologic implications have come to my attention.

The symptoms most commonly presented were difficulty in clearing aural pressure changes in flight, aural pain, poor hearing, vertigo, postnasal drip, frequent head colds, stuffiness and nasal blockage, sinus pain, headaches, concern that the frequency of tonsillitis might prevent performance of flying duty, gagging sensations, globus hystericus and aphonia. The cases were all carefully surveyed by qualified otolaryngologists, and it was found that the patients were either free from pathologic change or presented symptoms out of proportion to the degree of change.

When one considers the frequency of, and need for insight into, this problem, the psychiatric and otorhinolaryngologic literatures reveal a paucity of articles. Dunbar[1] drew attention to G. Gradenigo's article published as early as 1895 on hysterical disturbances of the ear. In general the literature concerning the ear covers a greater scope than does that of

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Presented as a candidate's thesis to the American Laryngological, Rhinological and Otological Society, Inc. in 1946.

1. Dunbar, H. F.: Emotions and Bodily Changes, New York, Columbia University Press, 1938, pp. 368.

the nose and throat. The objectivity of deafness and vertigo and the ease with which they are identified as "functional" probably account for this phenomenon. Mohr[2], in 1925, explained this paucity on the basis that otolaryngologists are on the whole too surgically minded.

Throughout the ages physicians have been well aware that emotional stress affects the course of disease. That the psychodynamics of such stresses and conflicts contribute to the causation of disease, however, is not accepted by some. It is said that older and more experienced physicians have acquired clinical judgment through the years which gives their work a certain psychologic finesse. However, an understanding of the somatic effects of psychogenic stimulation of the autonomic nervous system provides the younger doctor with a degree of understanding out of proportion to his experience. The patient is seen as a psyche and a soma, each affected by the other. Psychosomatic science is thus not a specialized branch of medicine, but is a psychophysiologic approach to all of its clinical problems. War experience has emphasized for many younger physicians the great importance of that approach. Internal medicine, perhaps, leads the field, and medical schools are rapidly modifying their training programs in this direction.

Probably no profession in medicine has been more mechanistic than otorhinolaryngology as practiced in the past. All treatment was approached from the point of view of pathology and anatomy, and surgery ruled this field. Fame awaited the inventor of an operation or instrument. Tonsillectomy was presented to the lay public as something that was a part of "growing up." Ethmoiditis was a focus of infection and the source of headaches, and ethmoidectomy, the cure. This thinking created in the public mind an antipathy toward the sinus-puncturing, septum-resecting and sinus-eviscerating otorhinolaryngologists. As a result, rebellion brewed among youthful scientists in the period following 1925, and a group of otolaryngologic physiologists emerged. Proetz fostered thinking along the lines of treating inflammation on a physiologic basis. This type of treatment replaced much surgical treatment. In scientific discussions various drugs and therapies were presented on the basis of their effects on the mucous blanket, the ciliary mechanisms, the p_H reaction, the histiocytic system and other functional arrangements. Arguments arose as to the application of silver protein U.S.P. and its inclusion in nose drops, and whether any treatment was indicated in a common cold. Because in large numbers of cases treatment was without beneficial results whether one employed the displacement technic, nasal douching with isotonic sodium chloride solution, administration of nonirritating vasoconstrictor drugs or other measures, a feeling of therapeutic nihilism arose in an even young-

2. Mohr, F.: Psycho-physische Behandlungsmethoden, Leipzig, S. Hirzel, 1925, p. 493.

er group of otolaryngologists. Lacking substantiation, some were prone to advise no treatment. Whatever psychosomatic treatment was given took place through crude suggestion, as in the painting of vocal cords for hysterical aphonia; or through the less conscious suggestive therapy that is involved in the temporary vasoconstriction and dehydration from packing the nose in rhinitis.

This state of affairs makes it seem desirable to survey some of the mental mechanisms presented by various types of patients who complain of diseases of ear, nose or throat and to search with insight for some psychodynamic basis of treatment. The ordinary stress of life tends to test normal balance of personality by the burden it imposes on the adaptive capacity (or ego strength). In the present study especially, stressful factors were obvious. However, the emotional tensions engendered in Army life were essentially secondary to those of civilian life. In order to better the understanding of these tensions I shall undertake in the following pages to describe very generally some of the forces operating in the development, structure and function of personality.

Personality represents the sum total of a person's technics for getting along in the world. It is composed of his knowledge, aptitudes and defenses. It is his way of life. Thus some people are regarded as cynical; others as energetic, skeptical, gay, warm or depressed. The personality of a given person is the resultant of two sets of forces. On one hand there are the primitive, instinctual impulses that demand satisfaction; on the other, and in conflict with them, are attitudes and outlooks developed through education and training. The latter envision aims, ideals and standards. Children are born dependent on parents for food, warmth, affection and security—they look to the parents to protect them from the dangers and uncertainties of life. The development of various types of personalities is influenced from the beginning by the behavior and the attitudes of parents. There are many factors that make a child insecure, and result in the later development of personality defects of all sorts. A child may be a girl instead of a wanted boy, an economic burden or a nuisance; it may be dull or unattractive, a competitor or even a toy. Such children will develop various defenses as a result of their basic feelings of insecurity. Under such circumstances one may see every degree of pathologic character formation, from relatively minor deviations to severe neurosis, criminality and psychosis. A happy child is one who receives love and kind attention from his parents. Thus armed and secured he grows up to meet the usual problems of civilian life with confidence and normal adaptivity. However, in combat the hazards can become too great or his adaptive capacity may be insufficient, owing to previous insecurities, so that he is unable to make the necessary adjustments.

Two major solutions may be achieved in this unfavorable or threatening environment. *Retreat* is one. In the "Air Corps Combat Fatigue

Cases" this solution was obviously sought by those who expressed a wish to retire to the farm after the war, to spend the remainder of their lives fishing, and, in general, to seek only peace and quiet. Phantasies of returning to a happy childhood were common, as were infantile regressions and practice of primitive magic. Some would not fly without their girl's picture, a coin or an old flying jacket. Religious sanctuary was sought by some in such attitudes as "God is my Co-Pilot." An extreme case of retreat was that of a gunner who had lost his father in infancy. He was the only child, and he was psychically very close to his mother. Shortly before being shipped overseas, he learned that his mother had died. However, he completed his combat missions without difficulty, and no special problems were observed. On his return from combat the realization of the loss of his mother suddenly "slapped him in the face." At that time he was without intimates with whom to spend his leave, and he voluntarily returned to duty in order to be sent to the hospital because of severe anxiety, manifested by restlessness, insomnia, battle dreams and tremors. Under treatment he told of the auditory hallucinations he had had on each mission, wherein his mother spoke to him and comforted him throughout the flight. This was his manner of retreating from reality. A complete retreat is seen in schizophrenia.

Another solution is *aggressive striving* for power. A child may hope to gain substitutes for the craved parental love and protection in the form of security to be expected from prestige and admiration. He may try, therefore, to become the hero of the football team, the first scholar in the class or a financier. While these attainments may bring additional respect, esteem and admiration, they never of themselves bring love. The basic insecurity still exists, and aggressive solutions do not bring protection, because he is then going through life with his "guard up," inviting challenge. Thus one arrives at the basis of neurotic strivings.

So long as the type of solution which the subject has chosen remains successful he goes along using various forms of it but never achieving the ultimate goal of happiness. He is constantly obliged to deal with varying degrees of tension, frustration and anxiety. Minor upsets of the ever precarious equilibrium may result in the development of such psychoneurotic symptoms as restlessness, palpitation, weakness, easy fatigability, hyperhidrosis and the other somatic evidences of stimulation of the sympathetic nervous system. It is as if the body were asked to respond to a state of danger when no obvious need for alarm exists. This is the usual condition of the neurotic person as he faces a world which appears to him to be personally hostile and dangerous. It manifests itself in somatic symptoms such as palmar sweating, tachycardia, diarrhea, hypertension, hyperchlorhydria and, more specifically in otolaryngology, as postnasal drip, discomfort of the eustachian tube with excessive tubal secretion, nasal

blockage, sneezing, itching of the ears, dysfunction of the balance mechanism, throat symptoms (gagging, globus hystericus and choking sensations), headaches, etc.

One of the most intriguing problems confronting psychomatic science is that of the choice of organ through which the symptoms are expressed. It is of especial interest to otorhinolaryngologists when the ear, the nose and the throat are selected as the site. The psychosomatic symptoms seem to focus on certain organs for definite but varied reasons. When the patient is faced with a need to retreat from or to avoid unpleasant or painful situations, the psychosomatic stimuli often affect an organ which has been the site of previous pathologic change and which has constituted a sort of locus minoris resistentiae. Then, again, symptoms may develop through the patient's identifying himself with a sibling, a parent or other important figures who earlier exhibited similar manifestations. Often these may be persons toward whom he has felt resentment or hostility. Often a symptom symbolizes an attitude. For example, globus hystericus seems to indicate "I can't swallow this blow"; vomiting, "I can't stomach that." Respiratory symptoms often seem in general to reflect an aggressive rejection of the atmosphere of the individual life. Finally, detailed studies of the individual case will reveal other more specific and less common mechanisms that appear to be operating in the production of the focal psychosomatic symptoms.

The consideration of presenting symptoms as being of functional origin or of somatic origin has given rise to a dichotomy in the thinking of many physicians. Each patient should be thought of as an entity. Each symptom is the resultant of psychic and somatic forces operating simultaneously. The surgeon dealing with somatic disease should be prepared to deal with the associated psychic aspects of the problem. Somatic disorder as concrete as carcinoma presents the problem of how to deal with the manner in which the particular patient's personality reacts to this danger. The importance of this general phenomenon is seen in the problem of the proper preparation of patients who are facing surgical intervention. Adequate psychic preparation of children who are to undergo tonsillectomy is a long neglected field. Thus the necessary physical restraint and the ether suffocation may mean to the little patient a threat to his capacity to struggle for survival. To him they are not technical procedures but an overpowering personally hostile fate. Numerous soldiers who were seen because of combat fatigue showed evidence of such effects. With the lowering of adaptive capacity due to strain of combat, regressions were common and often were associated with such traumatic childhood experiences. When interviewing flying personnel with the use of "penthothal sodium" I came across several whose reactions were clearly correlated with their struggling against anesthetization during myringotomy and

tonsillectomy. Recently a 7 year old girl was seen complaining of choking sensations and fearful and panicky feelings. She related the onset of her symptoms to the published horrors of the murder of Suzanne Degnan. She expressed fear that some such violent experience might occur to her. In this case the patient's feelings were found to be related to a myringotomy performed at the age of 4 when she was "held down, smothered, and her ear drum cut with a knife." Experienced psychiatrists presented with acute emotional problems now look almost automatically for an associated traumatic experience of childhood.

Psychic preparation of children who are to undergo surgical treatment may vary with different ones. In general the simple explanation of what is needed, and why, without instilling fear, is the best. Then some form of premedication, such as the administration of a small dose of a barbiturate contained in a suppository, plus the use of vinyl ether ("vinethene") to induce the anesthesia prior to switching to the open ether technic, will go far to alleviate psychic trauma. In the drama of the preoperative scene it must be remembered that to the child all except the surgeon are new and dangerous. The anesthetist should wait until the surgeon can stand by and give the patient reassurance during the induction of the anesthesia.

In fenestration surgery for otosclerosis one finds an outstanding example of relevant psychic factors. All are familiar with the seclusive, introspective personality of the deafened, who retreat from social intercourse because they so keenly sense their adaptive inadequacy. On hearing of the operation for the first time, the patient reacts with hopeful expectation and becomes guardedly enthusiastic. He sees again the possibility of personal adequacy and security. After undergoing the surgical treatment he lives in trepidation, and yet, at the same time, is hopeful and anxious regarding the outcome. Then for the first time in years he hears. The mood becomes progressively elevated until at times one appears to be dealing with a maniac. The surgeon is idealized, the discomfort of treatment becomes negligible, and the hope for the future is bright. The critical period of evaluating the result, approximately six months to a year, passes, and in successful cases there is restored to society a useful citizen, full of hope, creative energy, expectancy and self assurance. However, should the result of the operation then fail in a patient inadequately prepared psychologically for such an operation, one may see a depression which may result in further crippling of the personality, occasionally so severe as to involve suicidal tendencies. Adequate preparation in such a case involves a true evaluation of the possibilities of restoration of hearing, the degree of hearing to be expected, a guarded prognosis for the critical postoperative period and an effort to build up the patient's self respect and sense of status. It should be remembered that although the foregoing illustration demonstrates perhaps an extreme case, the picture

drawn is true of any case in which surgical treatment is instituted for chronic disability.

Office treatments other than surgical are a most important phase of an otolaryngologist's work. The attitude of therapeutic nihilism previously discussed can result only in the patient's seeking another physician or in his failure to be benefited. This attitude arises in the physician through guilt concerning the use of treatments for which he cannot find physiologic substantiation. At the same time the repetition of numerous laboratory tests and treatments serves only to fix the neurotic complaints in many patients. By understanding, by adequate explanation of how "nervousness" can cause symptoms and by use of treatments which serve to satisfy their need to have someone interested in them and helpful toward them, the physician can give many of these people relief. Therefore, the opinion that heat lamps, nasal packs, nasal sprays and other means of treatment are of no value in, for example, cases of low grade chronic sinusitis should be revised in regard to certain passive, dependent persons who lack a sense of security and react with tension. Reassured as to the outcome and treated for his symptom, he becomes fortified to face his daily work and shows signs of being helped.

Sometimes, as in cases of postnasal drip, it is adjuvant to explain to the patient how tenseness and anxiousness can stimulate the nasal mucosa to secrete excessively, just as an acute emotional upset causes the lacrimal gland to produce tears. This explanation plus the use of a vasomotor constrictor, cauterizing treatments, inhalations of a nebulized solution of penicillin, short wave therapy, or whatever fits the pathologic condition, may markedly benefit such a patient. The importance of maintaining a balance between fixing the neurosis by treatment and satisfying dependency needs and restoring self esteem by treatment cannot be overemphasized.

Superimposed problems often affect the balance adversely. A postnasal drip developed in a combat pilot when he learned that his wife had become pregnant. He was treated with douches of isotonic sodium chloride solution and with vasoconstrictors and completed his tour of duty admirably. Fortunately, he was returned from overseas to his home prior to his wife's delivery, after which he was remarkably improved.

In regard to nasal stuffiness and discomforts it has long been recognized that distention of the "blood lakes" of the nasal mucosa is associated with emotional crises. This association has been observed both on an experimental and on a clinical basis. In 1912 Seifert[3] reviewed the literature and found 300 essays on nasal obstruction and epistaxis accompanying menstruation and pregnancy. In addition to the vasomotor

3. Seifert, E. H. E.: Kritische Studie zur Lehre vom Zusammenhang zwischen Nase und Geschlechtsorganen, Wurzburg, Curt Kabitzsch, 1912.

changes, Fabricant[4] demonstrated changes of nasal secretion due to changes of mood, which transiently convert the mucus from a normal, slightly acid to an abnormal, alkaline state. This means that the acid reaction which serves as a barrier against infection is lost, a circumstance which may account for the increased frequency of the common cold in some persons. Innumerable flying personnel complained of nasal stuffiness with postnasal drip and pain of sinuses on descent. Mostly these symptoms were simply expressions of tension due to lack of security in the threatening situation of the perilous flight. For the most part the complainants were treated with reassurance as to the absence of disease and with vasoconstrictor nose drops. Some who required treatment in flight were given inhalers for use prior to descents. In a small number the symptom complex described was firm expression of the wish to be relieved of flying duties. Often explanation of the emotional correlation was enough to relieve the condition and allow continuation of duty. This was of use particularly when the patient's relationship to his group was such that being excused from flying duty on a psychic basis would imply "cowardice." An unusual case was that of an officer, extremely valued as a ground instructor, who had completed a combat tour. His masculine ideals were so high and his expression of symptoms so fixed that to give him insight into the mechanism could result only in his being lost to the Army as an effective soldier, because of the severe blow to his pride. In this case, for the good of the service, the patient was relieved from flying and thereafter gave his group the benefit of his experience in a ground capacity.

An interesting problem encountered in practice is illustrated in the following case:

A young and successful business man began to suffer from postnasal drip, stuffiness of the nose, and constant "smelling" of the odors of spoiled citrus fruits when drinking or eating, resulting in anorexia. He related the onset to driving home with his wife, after motoring through Florida, when the odor was actually encountered. Ears, nose and throat revealed no abnormality except an excessive amount of clear mucus postnasally, seen during a nasopharyngoscopic examination. The mucosa was normal. First, the patient was assured as to the absence of pathologic involvement. Then the excessive nasal secretion was described as being analogous to the lacrimal gland secretion that occurs when emotion produces tears. Finally, the patient was told of the case of a woman who complained of constantly smelling burnt bread because of guilt related to a clandestine affair. This woman had been seduced by the young man of the house in which she had worked as a maid, and during the experience the bread she had been baking began to burn. Her guilt associated with the experience was then displaced to the symptom involving the persistence of the smell of burnt bread. It was then suggested very generally to my patient that some unpleasantness connected with the trip was

4. Fabricant, N. D.: Effect of Emotions on the Hydrgen Ion Concentration of Nasal Secretion in Situ: with Comment on Terminology of Nasal Hydrogen Ion Concentration Measurements. Arch. Otolaryng. **43**:403 (April) 1946.

associated with his symptom. The odor disappeared, but the drip persisted. The latter was treated with trichloroacetic acid cautery with improvement. While no specific analysis of the patient's emotional difficulty was made, the mere alluding to the probability of such a difficulty had a beneficial effect on the symptom.

Headaches based on vasomotor conditions caused by emotional upsets have been identified both experimentally and clinically. Horton[5] described histaminic cephalalgia as occurring along ramifications of the external carotid artery. The headaches were often nocturnal and sometimes associated with tearing and rhinorrhea. They could be induced with histamine and cured by desensitization. He made no attempt to correlate vasomotor changes, histamine effect and emotional causes. Experimentally, headaches have been demonstrated with increased intracranial pressure related to distention of dural vessels in emotional hypertension. Ray and Wolff[6] showed that traction as well as dilatation of the intracranial arteries caused headaches. Simons and Wolff[7] by electromyographic studies have demonstrated headaches in post-traumatic cases as related to muscle contractions. These headaches could be modified by active and passive movements and eliminated by the injection of a 1 per cent solution of procaine hydrochloride. They attributed the headaches to either noxious impulses or sustained postural contraction in a pattern of tension, anxiety or fear. In some of their cases vertigo was associated and could be induced by pressure, and this induction failed after a 1 per cent solution of procaine hydrochloride had been injected into the deep tender muscle areas at the base of the skull or behind the ear. Headaches were a common complaint in flying personnel. As in civilian life, they were for the most part feelings of painful pressure on the outside of the head. They were frontal, occipital, vertical or circumferential. Many were worse on flying and, after high altitude missions, on descent. The latter made catarrhal sinusitis, especially in the English climate, a difficult problem in differential diagnosis. Pain caused by blockage of sinuses, occasionally associated even with hemorrhage in severe aerosinusitis, also had to be differentiated. Deceptive runs in the low pressure chambers were of great help. The patient was leveled off at a simulated altitude of 10,000 feet (3,000 meters) and told he was at 30,000 feet (9,000 meters). He was then told that he was descending when actually a slow ascent was begun. If the patient's headaches were psychogenic, he invariably complained of pain. These discrepancies

5. Horton, B. T., The Use of Histamine in the Treatment of Specific Types of Headaches, J. A. M. A. **116**:377-383 (Feb. 1) 1941.

6. Ray, B. S., and Wolff, H. G.: Experimental Studies on Headache; Pain-Sensitive Structures of the Head and Their Significance in Headaches, Arch. Surg. **41**:813 (Oct.) 1940.

7. Simons, D. J., and Wolff, H. G.: Studies on Headache; Mechanism of Chronic Post-Traumatic Headache, Psychosom. Med. **8**:227-242 (July-Aug.) 1946.

were checked and in appropriate cases explained to the patient, and often the treatment resulted in his completing combat tours without further difficulty.

Deafness, as has been stated, has long been demonstrated to be on a functional basis in some cases. This symptom will not be dealt with in detail, since it is not within the scope of this presentation. It usually involves hysterical conversion, which is differentiated from psychosomatic symptoms. Several radio operators, whose positions in air crews were dependent on their hearing, were seen with hysterical deafness. Because of the ease with which this recurred in emergency situations, the patients could be helped only by relieving them from the assignment and transferring them to other overseas duties. Patients with fixed hysterical deafness were surveyed out of service.

The case of a pilot with visual difficulties is presented because of the clear objectivity of the usual examination of the eyes. The case illustrates a transition from organic disease to hysteria. A tense pilot began smoking three to four packs of cigarets during each mission. He was examined by an ophthalmologist for loss of vision. Visual fields and funduscopy suggested tobacco amblyopia. He was grounded and tobacco withdrawn. As his scotoma disappeared, a peripheral constriction with telescopic vision was superimposed, which was relieved only by permanent grounding. A similar case was that of a patient in whom, following a flak injury to the neck, hysterical dysphonia developed. Examination revealed normally functioning cords. Sedation and assurance relieved the dysphonia.

Vertigo has been identified as a symptom of hydrops of the labyrinth. Many of the patients have been helped by treatment of the water imbalance. It is probable that this imbalance may originate as a vasomotor dysfunction, and this may account for the benefits reported with histamine desensitization and administration of nicotinic acid. It is felt that in some of these patients the pathologic process which results in the symptoms begins with a vasomotor imbalance. But just as fright can cause blanching and embarrassment blushing, temporary suppression of circulation to the labyrinth could cause vertigo and deafness, with the degree of the loss of hearing determined by the time and the degree of the suppression. To support this impression the following cases are presented.

An enlisted man, who married prior to being shipped overseas, suffered attacks of typical vertigo and deafness while en route to the port of embarkation, and was removed from the shipment. Nystagmus was observed. Subsequently his labyrinth reactions were hyperactive, but equal, and were associated with vasomotor collapse. All examinations, including allergic studies, made between attacks gave negative results. The patient was an extremely conscientious person, and interviews revealed that his symptoms were related to the fact that his sister had

been cared for by their father when she had meningitis, which began with vertigo. He stated that his father had treated her and watched her as if he were a physician. The patient had experienced hostile envy of the sister. It was felt that the attacks in question persisted because the experience of remaining behind while his group left to go overseas added new guilt to that with which he had been obliged to deal with for years.

Another man was subject to vertigo only prior to arguing with his boss. This patient was never seen in an attack, but caloric tests revealed that the left labyrinth was hyperactive and that he had a 25 per cent loss of hearing in the left ear. He described turning sensations in attacks. He was improved after the origin of his attacks had been explained on a psychic basis and after he had removed himself from the disturbing employer relationship by going into business for himself.

Previous treatment with histamine desensitization and nicotinic acid had failed. Antihistaminic drugs seem to improve this type of Ménière's disease. Further investigation regarding the psychosomatic relationship to the origin of vertigo should be fruitful.

Ear picking, in children, often seen on an erotic basis, can result in otitis externa. The scratching to relieve itching can be observed before the otitis and may account for the difficulty of treatment. The evidence that the child is gratified while being treated by the otologist is usually marked, and it is rare to see a recalcitrant child in the treatment of the so-called eczemas of the canal. The same situation applies to nasal therapy. That the nose is involved in sexual phenomena has been pointed out by many authors with respect to vicarious menstruation, nasal stuffiness associated with sexual stimulation and the gratification obtained by massaging the nasal mucosa.

Choking and gagging sensations are often seen on a psychosomatic basis. They may represent a rejection of the blow that life is dealing the patient. The symbolization expressed in the language "I can't stomach that" or "I could vomit" in such a distasteful situation has been previously discussed.

A soldier's wife, aged 30, was seen because of choking sensations. She had been examined for hyperthyroidism because of sweating, tremors and agitation and was referred for laryngeal examination because her basal metabolic rate was normal. This examination did not disclose any abnormality, and the simple question "Are you nervous?" brought forth the response that the choking sensations followed the beginning of her pregnancy and came on during sexual relations. On further investigation it was found that the girl had an older sister who became pregnant premaritally at about the time that the patient was 15 years old. At that time the patient was strictly warned that she would be thrown out of the house if anything like this happened to her. Until the girl was 24 years old she had no social contact with men. At that time she met a man with whom she fell in love, and during their courtship she repeatedly confessed the immodest desires the courtship involved. The war intervened, and the boy's overseas duty prevented marriage. On his return they were married, and all went well until she became pregnant. With the pregnancy the sensation of choking during intercourse began. When the symbolic relationship between the choking and the rejecting of inter-

course that was performed only for pleasure now that she was pregnant was explained, her choking disappeared.

Urticaria, hay fever, asthma, angioneurotic edema and vasomotor rhinitis have been demonstrated to be strongly associated with emotional problems. French and Alexander,[8] in summarizing the voluminous literature concerning the psychogenic factors of asthma, stated that attacks of bronchial asthma seem to be associated with a considerable variety of emotional conflicts. Outstanding among the causes are the suppression of any sort of intense emotion, situations threatening dependent relationships and the security based on them, and sexual conflicts. The outstanding personality traits of asthmatic children seem to be overanxiety, lack of self confidence and a clinging to the parents, which appears to be a reaction to oversolicitude on the part of the parents. Sudden fright has been reported to cure attacks of asthma. While the mechanism cannot be ascertained, it seems probable that the stimulation of the sympathetic nervous system effected under fear counteracts the asthma.

In the Army there was an unusually high percentage of patients with bronchial asthma on duty and in each general hospital. Some of these had suffered from asthma only since entering service. Many had their old asthma aggravated by service. The emotions aroused by the threatening situation of Army life plus the separation from home, where dependency needs were gratified, contributed largely to the high incidence of bronchial involvement.

Urticaria was seen in a student during final examinations after he ingested a malted milk. He showed sensitivity to malt during the anxious period of the examinations. He never had another attack and has not shown sensitivity to malt either on skin test or on test ingestions of malted milk.

Fabricant, as previously discussed, has correlated changes of the hydrogen ion concentration of nasal mucus with emotional stress in patients who complain of vasomotor rhinitis. It seems highly important in treating these patients to gratify their dependency needs. A physiologic explanation of how psychogenic upsets can cause excess glandular secretion, as it does in tearing and hyperchlorhydria, with reassurance as to the absence of "disease," does much to alleviate the anxiety of these patients. They are tense, anxious personalities and benefit from this reassurance plus local treatment and small doses of barbiturates. The antihistaminic drugs are proving of value in alleviating these forms of rhinitis.

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8. French, T. M.; and Alexander, F., and others: Psychogenic Factors in Bronchial Asthma, Psychosomatic Medicine, Monograph 4, p. 1, National Research Council, 1941.

SUMMARY AND CONCLUSIONS

Some of the mechanisms of psychosomatic problems encountered by otolaryngologists are presented. The otolaryngologist who in his work has cognizance of these associations is in a position to help a greater number of patients. The psychosomatic symptoms do not necessitate expert psychiatric care in all instances, and often such care is impossible because of the patient's being averse to psychiatric treatment, because of the expense or because of the shortage of trained psychiatric personnel. It is my feeling that the otolaryngologist should treat these patients just as long as their emotional conflicts and resultant symptoms do not impair their adjustments in interpersonal relationships. If more is needed at this point, psychoanalysis is the treatment of choice.

Karl Menninger has formulated six principles of psychiatric counseling that are worth repeating here.

"First, show the patient that you are interested in him."

"Second, don't lie to him, don't give him placebos or joke with him about his symptoms, and don't promise him anything."

"Third, listen to what he has to say, listen a long time, and listen many times, alone and without interruption."

"Fourth, listen without censoriousness in word and expression, without rebuke, ridicule, or amusement. Absurd as aspects of them may be, your patient's maladjustments are not funny to him."

"Fifth, give no advice, no treatment, and no opinion until you know what the patient is really unhappy about; then tell him that such unhappiness could be (not is) the cause of such symptoms."

"Sixth, gradually help the patient to see the connection between his unhappiness and his symptoms and to realize that he must assume the responsibility for making such changes in his techniques or his environment as will be likely to give him greater peace. This, rather than allowing him to throw all responsibility on the doctor, is the rational and only permanently successful method of helping him."

The experience of the wars has served to drive home the lesson that these patients require care as desperately as those who present acute surgical mastoiditis. The depreciating attitude expressed in the utterance "It is only functional!" or "My God, if I see another neurotic!" is antagonistic to the best interests of the patient. The burden falls on physicians to amplify their understanding of the dynamics of psychosomatic symptoms and to support research and graduate training in this phase of their work.

In the background of this article are the stimulation, teaching and advice of the following: Drs. Howard L. Werner, Eugene I. Falstein, Maxwell Gitelson, Roy R. Grinker, John P. Spiegel and the staff of the American Air Force Convalescent Hospital at St. Petersburg, Fla.

RECONSTRUCTION OF THE HELIX

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THE MOST FREQUENT deformity of the auricle is the loss of all or of part of the helix. This type of deformity is usually seen in burns around the head which involve the external ear and leave its margin scarred and jagged. The free border of the ear is sometimes lost as a result of marginal lacerations, or it may be sacrificed in the process of eradication of tumors. The recently introduced composite grafts of skin and cartilage taken from the helical portion of the auricle[1] also leave a deformity which calls for reconstruction at the time of the original operation.

There are two methods of reconstruction of the helix. The first one utilizes a skin tube.[2] Such a tube is ordinarily formed in the supraclavicular region where thin, hair-free skin is available. The tube is then migrated in stages toward the mastoid region and draped around the auricle. The roll of skin fairly well approximates the elevated and curled appearance of the helix.

In order to reduce the four or five stages required in such a procedure, skin tubes are occasionally formed (if non-hair-bearing skin is available on the upper part of the neck), based in the mastoid region. Because the skin of the upper part of the neck is much thicker than that in the supraclavicular region, the tubes are necessarily much more bulky and the resulting scar is on the exposed part of the neck.

The second method utilizes the postauricular skin in the form of a flap raised along, or parallel to, the postauricular sulcus. After the excision of the marginal scar, the denuded edge of the skin on the anterior surface of the auricle is sutured to the dissected edge of the flap. Whatever cartilage is protruding beyond the edge of the skin on the anterior surface is buried underneath the postauricular flap. The skin on the posterior surface of the auricle temporarily forms a skin-lined tunnel. In the subsequent stage, the flap is dissected free from the mastoid region

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1. Brown, J. B., and Cannon, B.: Composite Free Grafts of Skin and Cartilage from the Ear, Surg., Gynec. & Obst. **82**:253-255 (March) 1946.

2. Pierce, S.: Reconstruction of the External Ear, Surg., Gynec. & Obst. **50**:601-605 (March) 1930.

and its posterior edge adjusted to the skin on the posterior surface of the auricle. A skin graft is applied over the donor site in the mastoid region. This procedure achieves a smooth, rounded auricular border, but no attempt is made to simulate the elevated, curled appearance of the helix.

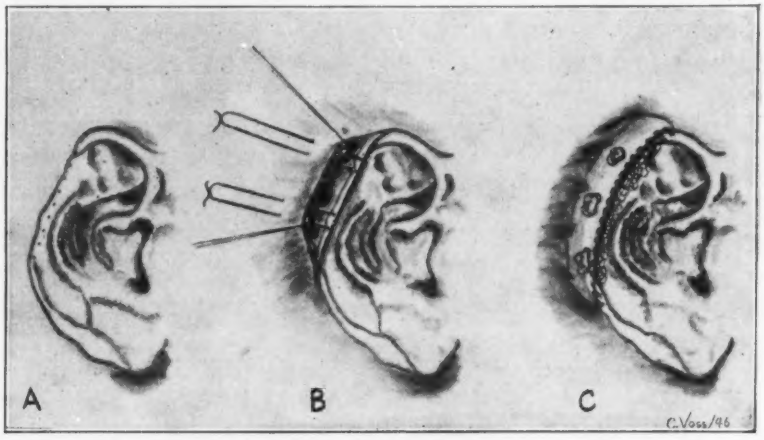

Fig. 1.—Diagram of the procedure for formation of the helix. *A*, loss of the helix. The dotted line represents the line of excision of the marginal scar. *B*, the denuded auricular border is pulled underneath the postauricular flap by means of mattress sutures. *C*, the postauricular flap overlaps the denuded edge of the auricle. A narrow packing is inserted underneath the raw margin of the postauricular flap. The sutures are tied over gauze or rubber pegs. The fine interrupted line represents the approximate position of the auricular cartilage underneath the skin flap. The heavy interrupted line indicates the posterior outline of the flap which will be dissected from the mastoid region in the second stage.

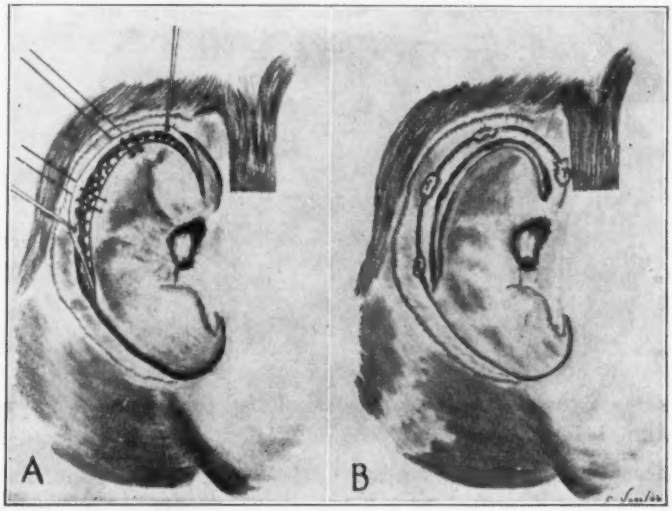

Fig. 2.—Diagram showing formation of the helix as part of a total otoplasty. *A*, superficial incision along the imaginary line of the scapha on the auricular plaque. The skin posterior to the incision is undermined. *B*, the posterior flap is made to overlap the anterior skin edge.

The procedure described in this paper utilizes the postauricular flap but attempts to recapture the effect of the helix. Instead of the conventional skin edge to skin edge suture of the postauricular flap to the anterior surface of the auricle, the former is allowed to overlap the latter. The denuded under surface of the postauricular skin along the border of the flap overlies the skin edge on the anterior surface for a distance of about 5 mm. This raw surface heals by secondary intention and the cica-

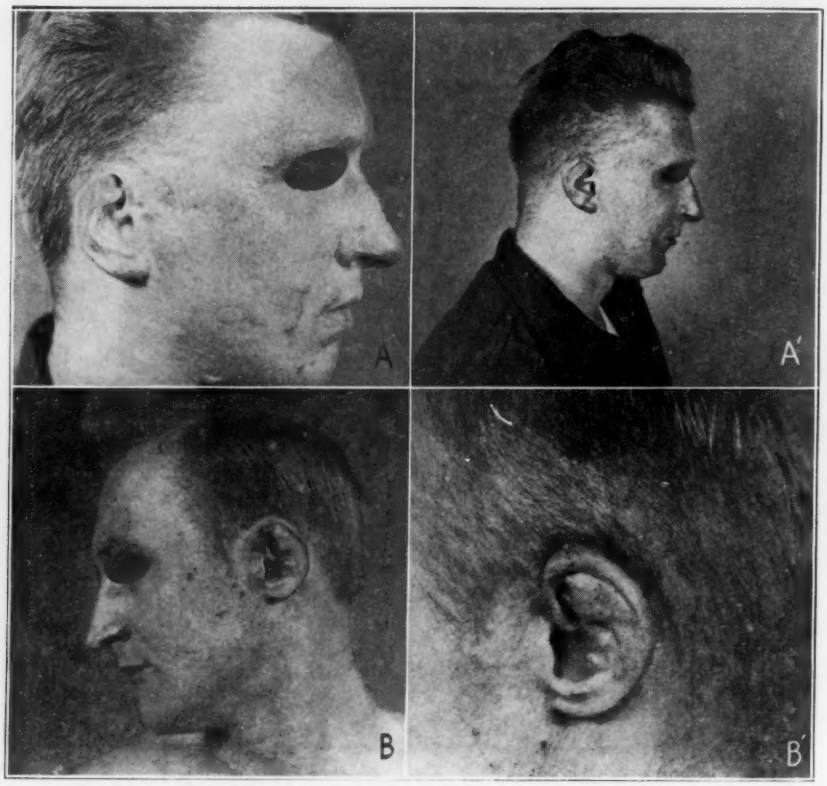

Fig. 3 (cases 1 and 2).—*A* and *B*, loss of helix secondary to a burn. Note the flat, irregular jagged appearance of the particular border. *A'* and *B'*, formation of the helix with a posterior flap as described.

trization process causes curling of the border of the posterior flap, thus simulating the appearance of the helix. The groove in front of the junction represents the scapha. The second step of this procedure does not differ in any way from the standard method.

In the subtotal or total otoplasty, the main body of the auricle is formed as described by Pierce. A fragment of cartilage is inserted underneath the mastoid skin. Subsequently the skin-cartilage flap is dissected, being left attached anteriorly. The posterior surface of the skin-cartilage flap and the donor site are skin-grafted.

If the cartilage is shaped to form a concave plaque with its posterior border elevated, it may create some suggestion of the helix. However, ordinarily the skin flap obliterates all the undulations in the cartilage.

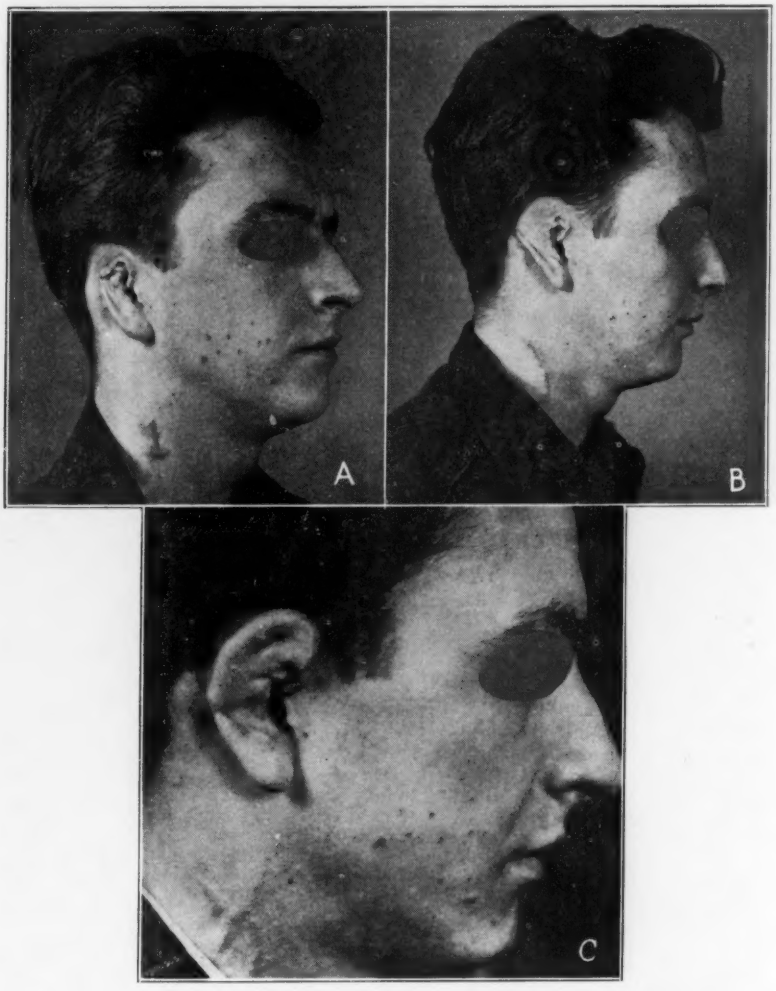

Fig. 4 (case 3).—*A*, loss of upper portion of the ear secondary to a burn. The auricular cartilage shriveled as a result of an osteochondritic process. *B*, reconstruction with a postauricular flap and preserved cartilage. *C*, the helix was subsequently formed by the method described. Note that the helix was not as well formed as in cases 1 and 2, figure, 3, since the posterior flap was not sufficiently mobilized because of the danger of complication described in this article.

Various attempts (formation of a thin skin flap, tight packing, mattress sutures) aimed at making the flap conform to the pattern of the cartilage were not successful. The vitality of the flap was jeopardized thereby and localized necrosis frequently developed. Therefore the accepted procedure was to form the helix by utilizing a skin tube.

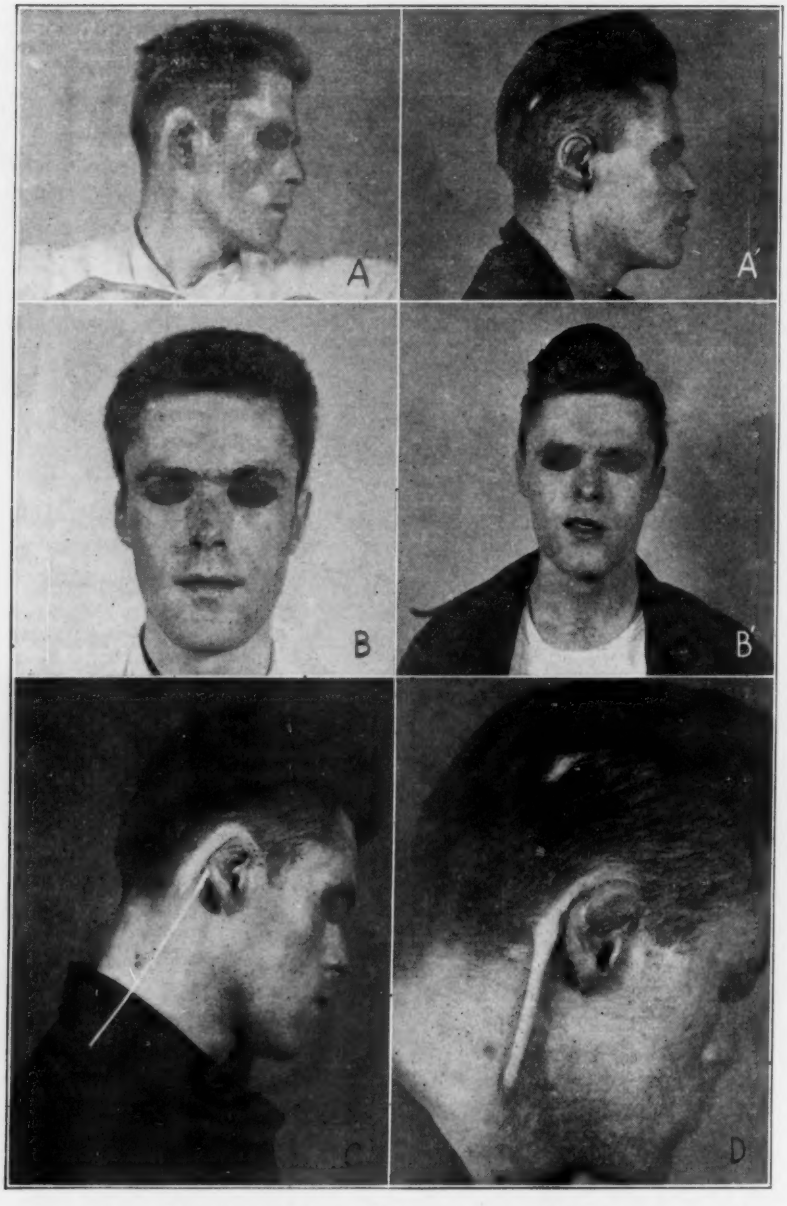

Fig. 5 (case 4).—*A* and *B*, partial loss of the auricle secondary to a burn. *A'* and *B'*, after reconstruction. *C*, reconstruction with the postauricular flap without a cartilage transplant. *D*, tube on the upper part of the neck was formed at the patient's insistence that he have a "roll" on his ear. This was done before the described modification was developed. The tube on the upper part of the neck was used as a short cut and was combined with the excision of scars on the neck.

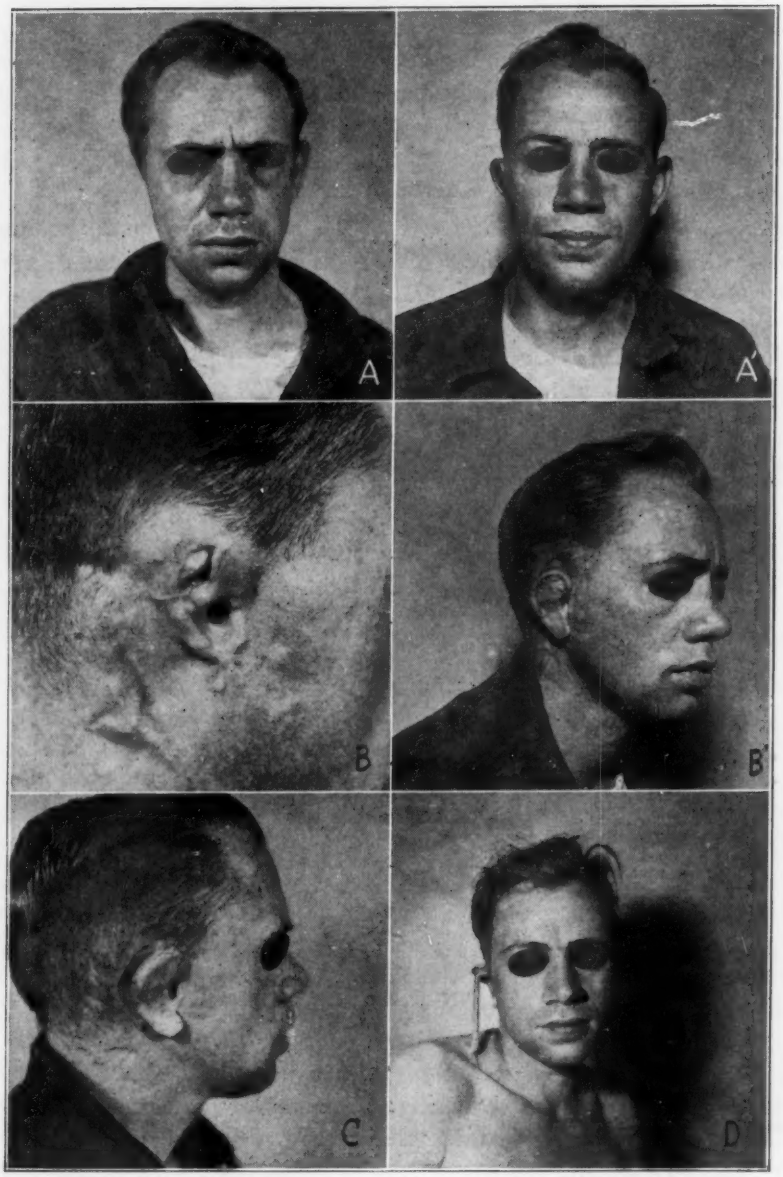

Fig. 6 (case 5).—Total otoplasty: *A* and *B*, complete loss of the auricle and scarring in the mastoid region as a result of a gunshot wound. The scars had to be revised before the mastoid skin could be used for reconstruction of the external ear. *A'* and *B*,' the pinna reconstructed. *C*, the auricular plaque was formed by the mastoid flap and one large fragment of preserved cartilage. Its posterior surface and the donor area over the mastoid were skin-grafted. *D*, the helix is formed with the supraclavicular skin tube. The procedure described in this paper was not carried out in this case because of the danger of exposure of the preserved cartilage and the possibility of the formation of a sinus.

The modification described can be used in this situation to great advantage. The position of the groove in front of the helix (scaphoid fossa) is outlined and an incision is carried along this outline. The posterior skin edge is undermined and, with the help of a few mattress sutures, the anterior edge is pulled underneath it, the posterior edge thus overlapping the anterior one for a short distance.

In cases in which the formation of the helix is part of the subtotal otoplasty and in which preserved cartilage was originally used, a great deal of caution is indicated. If the incision and dissection for formation of the helix expose the preserved cartilage and a granulating surface is left to heal by cicatrization, a sinus may form leading to the cartilaginous plate.

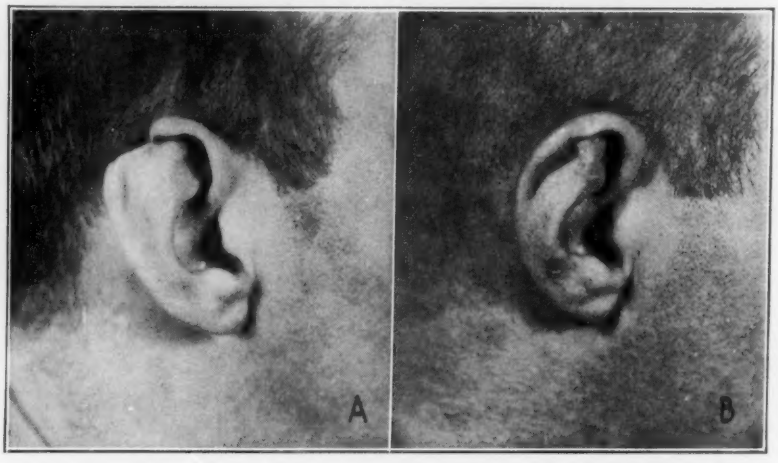

Fig. 7 (case 6).—*A*, partial defect of the helix which could be corrected with a postauricular flap. *B*, better result obtained by excision of a triangular fragment from the auricle and closure of the defect. The reduction in size of the ear is not noticeable, but if it were, it could be balanced by a similar reduction of the other ear.

Because of the alloplastic nature of the transplant, such a sinus may resist treatment and require the removal of all or part of the cartilage, thus endangering the final result. This complication may be averted by scrupulously avoiding exposure of the cartilaginous plate during the dissection. The posterior skin edge may be undermined, leaving a layer of soft tissue above the cartilage. The utilization of autogenous cartilage would also eliminate the possibility of such a complication.

SUMMARY

A modification of the accepted method of otoplasty is suggested which has proved effective in the formation of the helix. It utilizes the local tissue and reduces the number of operative stages usually required.

PROTRUDING EARS

Plastic Correction; Planning Technic; Operation

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EVERY YEAR several articles appear regarding "ear conscious" persons and describing technical variations of operations for protruding ears. In examining such persons, a glance is enough to convince one that nature has gone too far in developing their ears or has been neglectful in supplying enough antihelix. The esthetic rule to follow is to remove nature's "overemphasis" of the ears and yet retain bilateral symmetry and artistic balance of the ears and the face.

Prominent ears are of themselves trifling deformities, but their depressing effect on the personality is quite impressive. Possessors of "lop" ears are subject to the ridicule and jibes of their companions, and the more sensitive sufferers seek correction in order to accomplish two effects:

1. To eliminate the ridicule.
2. To correct the esthetic fault.

The surgical correction generally aids in changing the patient's emotional balance for the better and improves his social outlook. It is a source of pleasure to the surgeon to observe this change in a patient whose feeling of inferiority may have produced such a sense of inadequacy as to amount to an obsession. After surgical correction of the ears the patient invariably gains confidence, pride in his improved appearance and the important self satisfaction which goes hand in hand with the comforting thought that his ears are esthetically satisfactory to others and to himself.

Even the esthetically callous patient, in whom the consciousness of protruding ears produces no mental symptoms, may find it almost impossible to obtain certain types of employment because of this deformity. Therefore many persons who meet the public in their work seek this type of plastic surgery for economic as well as esthetic reasons.

Protruding ears are caused by congenital malformations. The greatest number of deformities of this type are concerned with the absence of the fold which constitutes the antihelix. This type of deformity may thus be called an intrinsic aural defect, in that the ear itself would be normal but for this midportion of it which is abnormal. The protruding ear may

From the Eye and Ear Infirmary, University of Illinois.

be a normal ear with satisfactory antihelix formation, but the ear as a whole may be attached to the head in such a way that the postauriculocephalic angle is too obtuse. This is comparatively rare. The present study is concerned with lop ears due to flattening or absence of the antihelix.

Normally the antihelix is a ridge of the auricular cartilage which is convex as viewed from the side. It is this convex fold of the auricular cartilage which bends the scapha and the helix centrally toward the cranium. In the lop or outstanding ear the antihelix is somewhat flattened, or actually absent. This causes the portion of the ear distal to it, to stand, "jug handle-like," away from the head.

The object of the more recently devised otoplastic operations is to restore the antihelix. By creating an antihelix, the scapha and the antihelix are bent closer to the head.

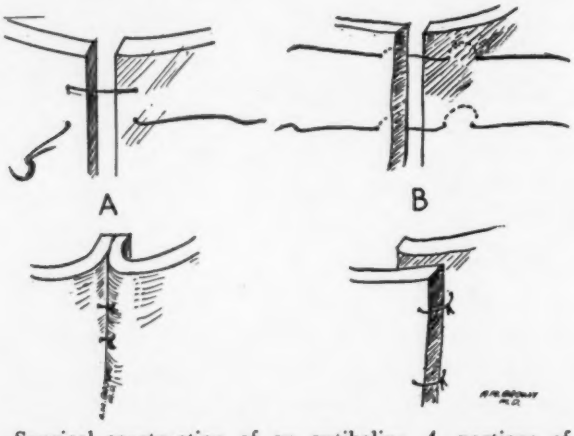

Fig. 1.—Surgical construction of an antihelix: *A*, portions of the incised auricular cartilage sutured back to back. *B*, portions of the incised auricular cartilage plicated, the distal sliding behind the proximal portion.

This correction is accomplished by incising the auricular cartilage along the line of the proposed antihelix. Then the cartilage is folded in one of two ways. 1. It may be folded on itself back to back (for severe lop ear). 2. The cut edges may be plicated, the lateral portion sliding behind the proximal portion. Either of these methods will create a new antihelix.

Thus, as seen in the illustrations, the severed cartilages are joined together either by mattress sutures which pull them together back to back (fig. 1*A*), or they are sutured so that the anterior surface of the distal portion is parallel to the posterior surface of the proximal portion (fig. 1*B*). (These technics have been described well by MacCollum[1] and by Davis and Kitlowski.[2])

1. MacCollum, D. W.: Lop Ear, J.A.M.A. **110**:1427 (April) 1938.
2. Davis, J. S., and Kitlowski, E. A.: Surgery, **2**:835 (Dec.) 1937.

It is in planning the operation and in selecting the type of excision and the manner of suturing that the result will be determined.

I wish to describe a method of predetermining: (1) the type of operation to be selected; (2) the amount of cartilage to be excised.

PLANNING THE TECHNIC

If the ears are symmetric, an impression is made of one ear in plaster of paris (calcined calcium sulfate; alpha gypsum). If they are asymmetric, impressions are made of both ears.

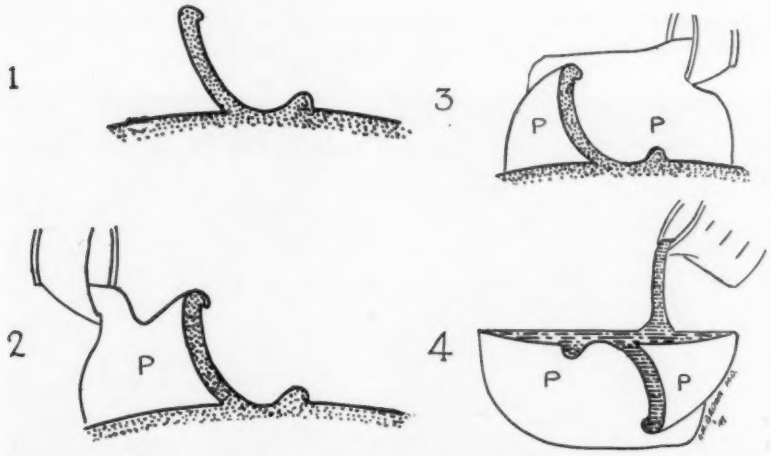

Fig. 2.—Method of making a latex duplicate of the deformed ear: *1*, ear in horizontal section; *2*, postauricular impression in plaster of paris; *3*, completion of plaster impression; *4*, impression removed from ear and reassembled. It is then inverted and used as a mold into which liquid latex is poured. This rubber ear serves as an experimental model on which to predetermine the choice of surgical operation.

The patient lies on his back, with the head turned, ear up. The external ear is anointed with petrolatum U.S.P. or rosewater ointment U.S.P. and the excess wiped off. The external auditory canal is plugged with cotton.

The plaster of paris is spatulated with water until it is creamy, and the impression of the ear is made in two parts, to avoid the undercuts of the ear. First the back of the ear, up to the helix, is coated with plaster as shown in figure 2, phase *2*. When this has set, its exposed surface is nicked here and there to form "keyholes," and it is coated with petrolatum lightly. A new batch of plaster is prepared, and the new mix is spread over the ear and over the first portion of the impression, also, as illustrated in figure 2, phase *3*. When this is hardened, both parts of the impression are removed, reassembled and dried.

When dry, the impression is filled with latex (fig. 2, phase *4*), to provide an experimental model for the surgeon. Any number of models can be made from the negative impression.

It requires about a day for the latex type positive to vulcanize, after which it is removed (fig. 3*A* and *B*). The rubber model is now ready. It may be incised, bent, and sutured, and the operation can be adequately planned in advance. The

type of excision can be determined, and the amount of ellipse to excise can be decided on. Whether to suture the aural cartilage portions back to back or to plicate them may also be predetermined.

OPERATION

The operation itself is performed with the patient on his back, with his head so draped that both ears are exposed. The ear to be operated on first is turned up by having the patient turn his head to one side. The hair is shaved, and the skin prepared with soap, water and alcohol. The antihelix is outlined in methylene blue on the anterior surface of the ear.

Local anesthesia is sufficient. The 2 per cent procaine hydrochloride solution with epinephrine hydrochloride is used, furthermore, to help elevate the skin away from the perichondrium in the operative area.

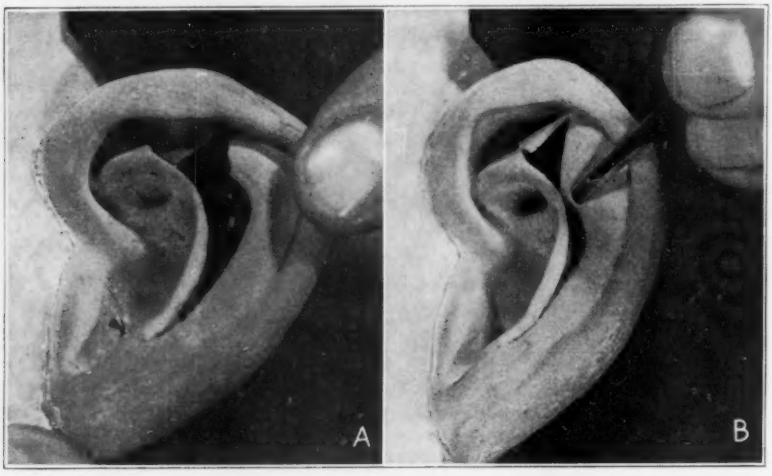

Fig. 3.—*A*, experimental excision of ellipse and auxiliary triangular excision performed on the rubber model ear; *B*, plicating operation illustrated on the latex ear.

The posterior incision is outlined by piercing the ear with a hypodermic needle dipped in dye (methylene blue, brilliant green), along the outlined proposed antihelix.

The skin is easily reflected back, the cartilage exposed, incised as the tattooed marks indicate, and the proper, predetermined excision of an ellipse is made. The cartilage must be cut through to its edge, above and below, to eliminate rebound elasticity.

Three or four sutures, as illustrated in figures 1 and 4, are used to anchor the portions of the cartilage in their new position. Fine silk or linen is the material of choice, the latter being preferred.

The posterior auricular skin will now be seen to have superfluous folds. One edge of the skin incision is overlaid on the other. Generally an ellipse measuring more than one-half inch across its center can be removed before the skin is approximated. Hemostasis is important. All bleeding and oozing should be controlled before the skin is closed.

Both ears should be judged symmetric before the bandage is applied. The bandage requires special attention. Before it is applied, the posterior auricular fold, the scapha and the concha are coated with a varnish consisting of:

Gum mastic	10%
Styrax	10%
Chloroform	80%

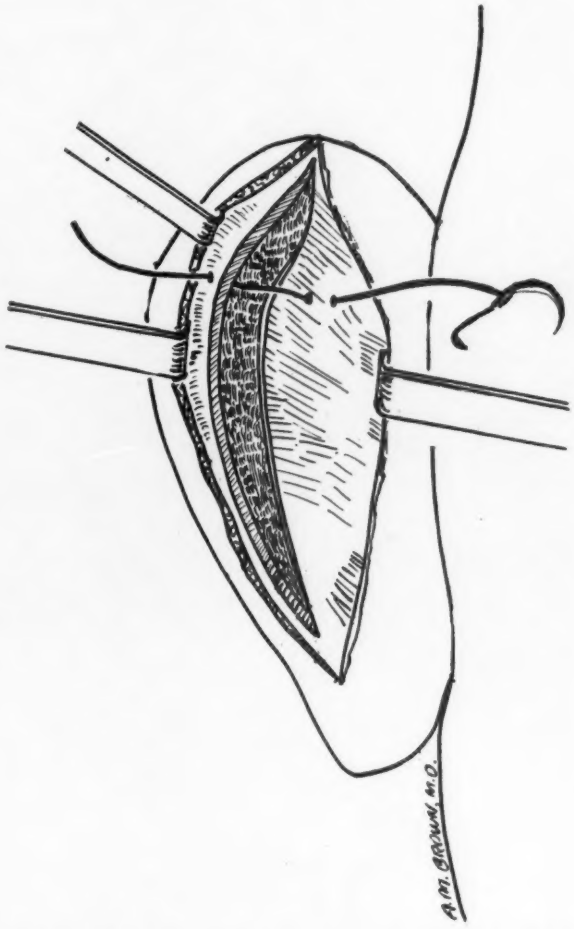

Fig. 4.—Incision of the skin, elliptic excision of auricular cartilage, and placement of a plicating suture.

Cotton is lightly but firmly laid along the posterior auricular fold and scapha, and packed into the concha. The varnish keeps the cotton splint in place firmly and accurately. Gauze pads are now laid on the cotton, and the head is firmly bandaged with a wet crinoline bandage. When this is dry, it is hard and light, and affords some rigid protection against bruising.

The bandage is left in place seven to ten days. Three or four days after the operation its upper edge may be lifted away from the skull for inspection of the upper edge of the helix as to its proper color.

Fig. 5.—*A* and *B*, anterior views before and after correction of protruding ears; *C* and *D*, posterior views before and after.

The satisfaction which the patient obtains from this operation is astonishing and gratifying. The test for a successful operation is the esthetic sense of the operator and the patient. What is the test as applied to

the patient and the public? The answer is: Ears should not draw attention to themselves.

1260 Lake Shore Drive

Fig. 6.—*A*, before correction of ears; *B*, after.

Fig. 7.—*A*, protruding ears with marked degree of asymmetry of the postauriculocephalic angles and of size; *B*, ears corrected. Each ear was reduced in size and corrected to form a normal antihelix. The two ears now match in size, shape and angle.

Case Reports

RHINOSCLEROMA

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PHILADELPHIA

RHINOSCLEROMA is encountered infrequently in the United States, but it should be suspected when there is an unusual-appearing lesion of the nose. Most of the patients whose cases have been reported were persons of foreign birth, chiefly from northeastern Europe, though some came from the Mediteranean area and South America. In 1942 Cunning and Guerry[1] found 102 recorded cases in the United States and Canada; 16 of the patients were native born and 86 foreign born.

Rhinoscleroma is classed as an infective granuloma, and Bacillus rhinoscleromatis is often found in the characteristic Mikulicz cells, but there is no certainty that this organism causes the disease. The lesion has been found in all parts of the upper respiratory tract, and is at first proliferative and then destructive. Generally, treatment has been unsatisfactory. It usually consists in applying roentgen radiation in low dosage to bring about fibrosis, although beneficial effects have been obtained in some cases with antimony compounds. Since the bacillus of rhinoscleroma is gram-negative, it is interesting to speculate on whether it is susceptible to streptomycin, but because the granuloma is slow growing, considerable time will be needed to determine the efficacy of antibiotic therapy.

REPORT OF A CASE

A 53 year old white woman, born in Poland and living at the time of examination in northeastern Pennsylvania, had experienced nasal obstruction for the past year. It was difficult to obtain an accurate history, owing to language difficulty, but this much was clear: There had been gradually increasing obstruction of the breathing through the right side of the nose for a year, and six weeks prior to examination she had noticed a growth in the right side of the nose.

On examination a large mass, measuring approximately 2 cm. in diameter, was seen in the right nasal fossa. It was freely movable and pedunculated, being attached to the mucocutaneous junction of the nasal floor by a broad pedicle. The surface was irregular, and the growth was firm but not hard; slight surface ulceration was observed along the free margin, which was in contact with the septum. No further evidence of proliferative disease was found in the remain-

From the Department of Laryngology and Broncho-esophagology, Jefferson Hospital.

1. Cunning, D. S., and Guerry, Du P.: Scleroma, Arch. Otolaryng. **36**:662-678, 1942.

ing portions of the upper respiratory system. The clinical diagnosis was: granuloma, type undetermined.

A roentgenogram of the sinuses was made, and the report was as follows: "The frontal sinuses appear fairly symmetric and average sized. The antrums, ethmoid sinuses and sphenoid sinuses are well developed. There is no definite evidence of sinusitis. No area of bone destruction is noted."

Local anesthesia was induced, and the mass was removed from the nose and submitted to the laboratory for histologic examination. The following report was made by Dr. C. J. Bucher:

Histologic Examination.—"Section of the tissue discloses a thin layer of stratified squamous epithelium. The underlying stroma is made up of loose, edematous fibroconnective tissue of increased vascularity. Throughout the stroma there is a dense infiltration of plasma cells of varying sizes. In addition there are also numerous foci of polymorphonuclear leukocytes. Scattered here and there are a few large, clear, foamy cells, which are the so-called Mikulicz cells. Some of these contain a few rod-shaped bacteria. In addition, there are also a few scattered cells containing pinkish-staining colloid-like substances. There are also a few scattered Russell bodies made up of irregular bits of hyalin-like material. Diagnosis: rhinoscleroma."

As therapeutic agents, roentgen radiation, in small doses, and streptomycin were recommended.

Clinical Notes; New Instruments and Technics

NEW DIAGNOSTIC PROCEDURE FOR BOECK'S SARCOID

A Preliminary Report

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Associate Clinical Professor of Otolaryngology of Columbia University
NEW YORK

It has hitherto been customary to look on Boeck's sarcoid as one having to do mainly with a morbid process of the skin. Periodicals normally occupied with the interests of dermatology have carried the most extensive studies thereof. In more recent years, as the knowledge of the disease broadened, reviews on tuberculosis have carried an occasional treatise. And now, that it is well known that sarcoidosis does not confine itself to a local area such as the common integument, but may and does attack every organ of the body, specialists of other branches of medicine have taken up the task of probing the extent of this insidious disease. As a result of the latter effort articles have appeared recently in numerous periodicals other than those just mentioned. Journals on otolaryngology are showing some activity in this field. Rhinolaryngologists are calling attention to the fact that the nose, larynx, trachea and ear are also involved from time to time.

Descriptions of Boeck's sarcoid found in the literature are mainly of cases in an advanced state of development; a monograph on an early case is rare. This situation has continued from the time Boeck made public his memorable work in 1899,[1] and it strangely persists to this date. I know of only one exception. It will be discussed in a later paper. Despite some credible roentgenologic studies lately released, no new diagnostic methods have been advanced. When confronted with the task of working up a new case in the clinic the same tests that were uncovered long ago are apt to be repeated again and again. The present armamentarium appears singularly incapable of authenticating the condition in its early stages, i.e, at a time when there is little damage present.

The theme of this paper is to propose a procedure new in its application. It is new so far as I know from a careful perusal of the literature and from conversation with other clinicians. This method enables the physician to determine sarcoid morbidity when present in a person at a time when few symptoms are present. Until recently practically all patients with these cases came under the care of a dermatologist, due to the dermatologic changes the patient observes and against which he seeks relief. When cutaneous lesions are present the clinician experiences little difficulty in recognizing the ailment, but during this phase of the development of the disease numerous other organs are also involved. The degenerative process has fairly well advanced. The changes in the integrity of the integument are the core of the symptom complex which the clinician used for

From the Department of Otolaryngology of the New York Post Graduate Medical School and Hospital of Columbia University.

1. Boeck, C.: Multipelt benignt hud-sarkoid [d'un sarcoide cutane multiple et benin. Res., 1386-1388], Norsk. mag. f. lægevidensk. 14:1321-1334, 1899.

years to bolster the diagnosis, and when alterations in the skin were not present recognition of the illness was most difficult. The method advanced in this thesis, if carried out, can establish the diagnosis even in the absence of cutaneous lesions.

While examining patients with sarcoidosis having the usual cutaneous lesions, I have found that the percentage of those with infiltrations in the nose, located particularly in the septum, was rather large. This information has been of inestimable value in furthering definite diagnostic conclusions in the following case.

REPORT OF A CASE

S. C., a 31 year old Negro woman, in domestic service, first appeared at the Skin and Cancer Unit of the New York Post-Graduate Medical School and Hospital of Columbia University, April 1, 1943. She wished to have a growth on her left cheek removed. Further questioning elicited the information that the tumor was slowly but gradually enlarging. The usual examinations were made, and the routine chart prepared. Afterward she was referred to the plastic department of the hospital, and on April 9, 1943 she presented herself for examination. The routine notation was made: "The nevus was situated on the left malar region, and was about 1 by 1¼ inches (2.5 by 3 cm.) and raised about ¼ to ½ inch (0.6 to 1 cm.) above the skin level." Biopsy of the mass was not undertaken.

Simultaneously the patient complained of difficult nasal breathing, an occasional nosebleed, headache and slight dizziness. As a consequence of the complaint she was referred to the rhinolaryngologic clinic, where she was examined by me. The lower turbinates were slightly turgescent bilaterally, and a small quantity of mucopurulent material was present in the lower meatus, which was removed. The mucosa of the nasal septum on the left side, approximating an area midway between the anterior inferior spine and the vomer, was covered with a small amount of dried blood. The blood was softened with hydrogen peroxide and then gently cleared away. After the septum was cleansed of all debris, several small elevated points were seen on the cartilaginous septum close to the vomer. Their sizes varied. Some were tiny and required magnification to be seen. Others were the size of a pinhead, while one or two were slightly larger. The color was pale to grayish. The surfaces were smooth and unbroken. Their appearance, in general, suspiciously resembled granulations I had seen in cases of proved sarcoidosis. The infiltrations were removed and sent to the pathologic laboratory for microscopic examination. At the same time the patient was sent to the roentgenologic department for roentgenograms of her chest and of her fingers. Tuberculin tests were initiated at once; her reaction to them were negative.

In the plastic department the tissue was surgically removed, and the defect was covered with a skin graft. At the time of operation the surgeon made a notation that the structure was a neurofibroma.

The report on the nasal granulations from the pathologic department follows.

Microscopic Examination.—Section showed a piece of mucous membrane covered by hyperplastic stratified squamous epithelium with parakeratosis. The underlying stroma was replaced by granulation tissue composed of numerous small and large granulomas. These consisted principally of epithelioid cells, some of which showed abundant finely granular cytoplasm. At the periphery of the granulomas there was a scant sprinkling of lymphocytes and occasional plasm cells and eosinophils. There was no central caseation. Beneath the surface epithelium

there was a thin layer of congested granulation tissue composed of fibroblasts and infiltrated with chronic inflammatory cells.

The diagnosis was Boeck's sarcoid of the mucous membrane in the region of the nose.

At a later date I performed a submucous resection of the nasal septum. I was anxious to learn whether the cartilage underlying the mucosa, that bore sarcoid infiltrations, was also involved. The cartilage, perichondrium and the mucous membrane of the nasal septum, after their removal, were immediately conveyed to the pathologic laboratory. The pathologists' report on the tissue stated that tubercles of epithelioid cells were found in quantity in the mucosa, but none were found in the cartilage.

Roentgen Examination of the Chest.—Examination of the thorax showed a spherical heart with a moderate accentuation in the auriculopulmonic area. The transverse diameter of the heart was otherwise within 10 per cent of the limits of normal.

There was a large mass of lymphomatous type, somewhat nodular and protruding in the main from the hilus beyond the upper right cornu. The deviation of this mass density extended about 7 cm. to the right of the median line. There was a further moderate generalized accentuation at the hilus and root. The peripheral pulmonary fields otherwise were fairly clear, with no definite evidence of recent parenchymatous infiltration of pleural involvement.

Conclusion: The heart was spherical. A lymphomatous type of mass protruded beyond the right upper hilus. There was moderate secondary central thickening.

Roentgen examination of the phalanges of the hands showed no gross osseous or articular abnormality except small punctate areas of rarefaction in the cancellous structure in either end of the midphalanx as well as near the head of the proximal phalanx of the little finger of the right hand.

Supplementary exposures of the feet showed no gross osseous change other than that ascribable to shoe pressure and slight tendency to hallux valgus.

Conclusion: There were punctate areas of rarefaction in the cancellous structure of the metacarpal bones of the little finger of the right hand. Roentgenographic examination and interpretation were performed in the roentgen department of the New York Post-Graduate Hospital.

The micropathologic report of the growth, received later, stated that it, too, contained numerous tubercles of epithelioid cells.

COMMENT

The diagnosis of sarcoidosis, the disease from which this patient was suffering, was made with apparent accuracy, by assembling and correlating three principal factors, namely, microscopic study of granulations removed from the nose, roentgenograms of the chest and negative reaction of the patient to the tuberculin test.

It may be argued that the department of pathology on examining a microscopic slide and finding tubercles of epithelioid cells is not justified in accepting the same as sufficient evidence to make a diagnosis. I do not believe that a reputable pathlogist would care to assume such responsibility. The microscopic morphology of Boeck's sarcoid and Koch tuberculous tissue is practically of the same pattern. In fact, so closely does one resemble the other that if a microscopic slide of either is shown to a good general pathologist he will unhesitatingly say

that it is either one or the other, but will not commit himself by adherence to either without further clarifying information.

Roentgen pictures by themselves of the chest or of the phalanges or of both do not, as yet, offer sufficiently characteristic evidence to serve more than as an aid in conjunction with others to be of genuine value to the clinician who is seeking to determine the illness from which his patient is suffering.

Tuberculin anergy is found in persons who are victims of maladies other than sarcoidosis. It, alone, therefore, cannot be given the prominent role of acting as the identifying agent without further support.

The correlation of the triad, however, when each corroborates the other, presents sufficient evidence to the clinician that a diagnosis of sarcoidosis can be made with a good degree of certainty.

In the case herein reported the patient was seemingly devoid of any and all dermatologic lesions. The diagnosis was established in the absence of any cutaneous infiltrations. It follows, then, that recognition of the disease can be made with a high degree of accuracy if tissue can be obtained from the nose, the microscopic picture showing the characteristic pattern that has become commonly accepted by competent pathologists as sarcoid, supported by roentgen evidence of lymphomatous masses in the chest, plus a negative reaction to the tuberculin test. Lesions of the common integument may be entirely absent.

CONCLUSIONS

1. As I have found infiltrations in the nose repeatedly in the small series of known cases of sarcoidosis examined, it is highly suggestive that nasal involvement occurs far more often than the few cases reported in the literature would indicate.

2. The diagnosis of sarcoidosis in the case herein described was satisfactorily established without knowledge that the skin lesion was also, histologically, of sarcoid nature.

3. A clinical procedure is herein proposed for the diagnosis of sarcoid by the correlation of a microscopic study of tissue from the nose with roentgenograms of the chest plus a negative reaction to the tuberculin test. As far as I have been able to ascertain, this diagnostic procedure is advanced for the first time.

4. The rhinologist should be a principal member of the diagnostic team, and will undoubtedly assume his rightful place when alerted by more frequent and adequate descriptions of Boeck's sarcoid in rhinologic literature.

A NEW DRUG FOR THE CONTROL OF COUGH

LOUIS E. SILCOX, M.D.
PHILADELPHIA

Cough is primarily a physiologic act, protective in character. Under pathologic circumstances it occurs as a symptom of local or general disease conditions and may be of mechanical or reflex origin. It is essentially a quick and forcible expiratory effort or series of such efforts performed with partial closure of the glottis, and is usually preceded by one or more deep inspirations. When a foreign body or other irritant comes in contact with the peripheral fibers of the vagus nerve, or of those nerves with which it is intimately connected, impulses travel along the afferent fibers to the respiratory center of the medulla. In the ganglion cells of this center the impulses are translated into others which are conducted through the efferent fibers of certain cerebral and spinal nerves to the muscles of respiration, whose force they liberate.

Cough has for its object the removal from the air passages of foreign bodies, obstructive or irritating materials. It may be excited by irritation of the nerves when there is nothing to be extruded and is most annoying and persistent under such circumstances. Cough is regarded as a normal useful mechanism when the rates of production and the disposal of materials in the tracheobronchial tree are unbalanced by some pathologic process. This imbalance of production and disposal of materials might be caused by one or more of several factors:

A. Excessive production of tracheobronchial fluids or solids in response to irritants such as infection, local lesions, foreign bodies and toxic inhalants.

B. Blocking of any one of the pathways for removal of material from the tracheobronchial tree such as:

1. Diminished blood flow with a change in the ratio of effective arterial pressure to effective venous pressure or alteration in vascular permeability as in cardiac decompensation or prolonged local infection.

2. Obstruction of the lymphatic vessels or decreased pulmonary excursions such as in pulmonary lesions and excessive depression of the respiratory center.

3. Arrest of ciliary activity as in virus disease, avitaminosis A, exposure to cold, prolonged sedation and anesthesia.

Cough is regarded as an abnormal useless mechanism only when it is set in motion in response to stimuli within or without the tracheobronchial tree which are not discharged by the act of coughing. A productive cough might persist beyond the period of its usefulness as a cleaning process for infectious material when the production of tracheobronchial fluids is excessive. It is desirable to control this type of useless cough. A useless nonproductive cough may persist because of an inflammatory congestion secondary to continuing infection, a noninflammatory edema from hypersensitivity of the mucous membranes or mechanical trauma due to prolonged coughing. Irritating dryness of the larynx secondary to excessive talking or singing or dryness of the pharynx secondary to nasal congestion are com-

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Presented before the College of Physicians of Philadelphia, Section on Otolaryngology, Dec. 18, 1946.

mon causes of useless nonproductive coughs. Irritation of the pleura, stomach and even the ear can cause persistent cough, and since the act of coughing cannot remove such stimuli except by tearing out fixed tissues it becomes desirable and important to apply measures for control.

A new drug is being introduced for the control of useless nonproductive coughs, which is chemically known as 2 amino—6 methyl heptane. It is a volatile substance which in vapor phase produces local vasoconstriction, anesthesia and analgesia of mucous membranes. It is colorless, slightly soluble in water and soluble in benzene. Its specific gravity is 0.7. The boiling point of the free base is 155-156 C. at atmospheric pressure. It readily forms salts such as the hydrochloride and the sulfate. Its safety for clinical use has been established by experimental work in animals and human beings.

ANIMAL PHARMACOLOGY

The LD_{50} or lethal dose for half of the experimental animals of the sulfate of this drug by intraperitoneal injection was found to be 70 mg. per kilogram of weight in mice, 40 mg. per kilogram in large adult Wistar rats, 50 mg. per kilogram in guinea pigs and 75 mg. per kilogram in rabbits.

Ten Wistar rats were given injections with 20 mg. per kilogram of the hydrochloride of this drug daily for twenty-eight days with no untoward reactions in the group.

Rabbits, guinea pigs and dogs have received daily doses of this drug by injection and inhalation varying from 5 mg. to 25 mg. per kilogram for periods ranging from ten to thirty days, at the end of which time the animals were killed; their organs, when studied by a pathologist, showed a uniform lack of any histopathologic changes.

Pressor studies on 14 anesthetized dogs revealed that this drug exhibited 1/450 to 1/1,000 the pressor activity of epinephrine. This rise in blood pressure was found to be caused in large part by increased cardiac output.

HUMAN PHARMACOLOGY

The drug, 2 amino—6 methyl heptane, has a low toxicity. Two patients received 125 mg. of the hydrochloride subcutaneously with minor side effects. No toxic effects were noted after dosages of 125 mg. intravenously and 200 mg. of the sulfate by mouth. The average dose by inhalation for the control of cough is 0.5 mg. per inhalation.

Blood pressure increases of 20 to 30 mm. of mercury systolic and 10 mm. of mercury diastolic were noted after the administration of 125 mg. of the hydrochloride subcutaneously. The changes were transitory, returning to normal within one hour.

There was no stimulation of the central nervous system and no excitability after 125 mg. of the drug was administered intravenously to normal subjects.

Eight patients who had been hospitalized for the treatment of hypertension with blood pressure recordings from 240 systolic and 120 diastolic to 162 systolic and 80 diastolic used this drug daily in inhalation form for ten days to determine whether it would produce a pressor response in hypertension. There was no increase in blood pressure in any instance.

A study of 19 normal subjects conducted by Elsom and Rogers before and after three months of daily inhalation of volatile 2 amino—6 methyl heptane revealed no significant change subjectively or objectively. This study included electrocardiographic tracings, blood pressure recordings, weight, neuromuscular and

cardiovascular evaluation, general physical examination as well as examinations of the nose, throat and larynx, complete blood count and urinalysis for each subject.

The clinical observations on patients with coughs of various etiology were carried out in hospitals, clinics and private practice. The analgesic, local anesthetic and vasoconstrictor properties of this drug have been utilized in the control of cough in 242 patients in this study. Incorporated in an oralator which yields an average dose of 0.5 mg. per thousand cubic centimeters of air inhaled it has proved effective in over 75 per cent of selected cases observed. The early studies were made on all types of coughs—productive, nonproductive, asthmatic and neurogenic as well as cough due to habit. In pathologic processes such as pneumonia with excessive sputum cough was not controlled. Asthmatic coughs were poorly controlled with this drug and those of neurogenic origin not at all. The type of cough most effectively controlled was that due to tracheitis or bronchitis or the dry cough associated with a "cold." The drug was found to be especially useful

Result of Use of Drug on Various Types of Cough

Diagnosis	Treated Patients	No. with Effective Control of Cough	No. Without Effective Control of Cough
Acute tracheitis	54	40	14
Acute laryngitis	48	37	11
Acute bronchitis	37	30	7
Bronchosinusitis	36	32	4
Bronchial asthma	12	2	10
Bronchopneumonia	6	0	6
Lobar pneumonia	4	0	4
Chronic laryngitis	10	7	3
Chronic bronchitis	16	13	3
Pertussis	3	1	2
"Smokers' cough"	10	6	4
Neurogenic cough	2	0	2
Bronchiectasis	4	1	3
Total	242	169	73

for patients in need of cough medication who were sensitive to codeine and other ingredients of the ordinary cough prescriptions. No case of sensitivity to this drug has yet been observed.

The method of treatment with this drug which was found to be most efficacious was to have the patient inspire deeply five or six times with the inhaler between his lips, and to hold his breath between each inspiration so that the volatilized drug would diffuse through the tracheobronchial tree in adequate concentration to control the cough. Initial cough was produced in many of the subjects following the first inspiration, but rarely with succeeding ones. No untoward effects from the use of the drug were noted in any of the patients studied.

The modus operandi of this drug in the control of cough is still a matter of conjecture, but the property of local anesthetic action is probably responsible. Perhaps the other two properties of analgesia and vasoconstriction act synergistically.

Abstracts From Current Literature

Ear

RUPTURE OF THE TYMPANIC MEMBRANE OF BLAST ORIGIN. F. BOYES KORKIS, J. Laryng. & Otol. **61**:367 (July) 1946.

Korkis examined and treated 167 soldiers at a military base hospital who had, among them, 211 ruptured ear drums. Healing of more than 50 per cent of the drums took place in from one to five weeks. It was found that the high explosive shell was the agent most frequently responsible for the lesion. In cases of unilateral rupture the ear nearer the source of the explosion was the one usually affected, the direction of the axis of the external canal relative to the source of the blast wave being an important factor.

The Weber and Rinne tests were found highly unreliable in giving an accurate diagnosis of the type of deafness. The audiometer and the fork tests showed that in most of the cases the deafness was of the mixed type.

It was further made plain that a great deal more study and investigation are necessary to determine the rate of recovery of hearing and the ultimate prognosis as regards this.

The paper is well written; it is amply illustrated with audiograms and shows the result of careful and detailed follow-up.

LIEBERMAN, Philadelphia.

TREATMENT AND PREVENTION OF DEAFNESS OF TUBAL ORIGIN BY RADIUM IRRADIATION OF THE NASOPHARYNX. JEAN REYNAUD, Ann. d'oto-laryng. **64**:26 (Jan.-Feb.) 1947.

A review of the various methods of applying radium advocated by Crowe, Baylor, Fowler and Proctor is presented.

In this article Reynaud compares the various findings reported by the aforenamed workers in this field. His plea is that this type of therapy should be in more widespread usage among the otologists of France when the facilities are available.

VIOLE, Beverly Hills, Calif.

OTOLOGIC FINDINGS AND COMPLICATIONS IN SCARLET FEVER OTITIS. EINO VAHERI, Acta oto-laryng. **35**:46 (Jan.) 1947.

From Helsinki, Finland, Eino Vaheri reports on an investigation of many years' duration, which has covered 2,606 incidences of scarlet fever and included the otologic complications and implications for the disease. Of the patients 20.3 per cent had middle ear infections. Nasal infections were also found to be common. These could occur either early or late in the course of the disease. Seasonally, otitis was highest in the spring of the year; it was also high in the winter. It was lowest in the summer months. The younger the patients the higher was the incidence of otitis. The average duration of the disease was slightly

over twenty days. The earlier in the course of the disease otitis appeared the longer was there a tendency of the ear to discharge.

Of the whole group of patients with otitis, 9.3 per cent required mastoidectomy. Of these, 5 required bilateral mastoidectomy. In the group in whom otitis was in an early stage the operative frequency was slightly higher.

In a series of 131 patients a long term follow-up was accomplished. Less than 10 per cent of this group had hearing defects. In 30 per cent, as was to be expected, there were changes of the tympanic membrane of some sort. The usual finding was a total defect, a large marginal defect or a total defect of the pars tensa. Cholesteatoma occurred in 30 per cent of the follow-up group. Complete deafness was noted in twenty-one ears. Deafness could occur either early or after some years. Labyrinthine involvements were rare, and when they did occur, it was usually during the chronic phase of the disease.

LEWY, Chicago.

HISTOLOGIC STUDIES OF THE LABYRINTH, INCLUDING LABYRINTHINE COMPRESSION. S. H. MYGIND, Acta oto-laryng. **35**:108 (Jan.) 1947.

Mygind presents what he calls a conclusive review of experimental histologic studies of the labyrinth. He states that these have been in general characterized by endolymphatic compression. This compression may be produced by a variety of agents, but the effect is essentially the same. Drugs, e. g., quinine and pilocarpine, produce this effect and have been shown to cause the clinical symptoms of Ménière's disease in experimental Lyman subjects. He believes that the clinical symptoms appear to be in general harmony with specific physiologicopathologic changes.

Examples of the last point follow. The sensation of intra-aural pressure may be assumed to be due to a tightening of the fenestras, which are dislocated outward as a result of increased intralabyrinthine pressure. Vertigo and nystagmus are due to increased hydrostatic pressure on the cupula and the otolithic membranes. Tinnitus is caused by compression of the organ of Corti.

Hardness of hearing of the Bass type is due to fixation of the tectorial membrane against the organ of Corti.

LEWY, Chicago.

Pharynx

A STATISTICAL STUDY OF POLIOMYELITIS IN RELATIONSHIP TO TONSILLECTOMY. PAUL M. PEDERSEN, Ann. Otol. Rhin. & Laryng. **56**:281 (June) 1947.

Pedersen reviews observations made on 492 patients who were hospitalized for poliomyelitis in San Francisco in the years from 1941 to 1945. In the area from which these patients came 2,057 cases were reported.

During the same period and in the same area 57,796 tonsillectomies were performed. It was found that during an epidemic year (1943) there was 1 case of poliomyelitis to 1,960 of population, while the incidence of the disease following tonsillectomy for the same period was 1 to 1,782 of population. In other words, the incidence following recent tonsillectomies is not greatly out of proportion to the ratio of the disease to the general population during an epidemic year. It was found that when poliomyelitis does occur following tonsillectomy, it is more apt to be of the bulbar type, and there is a higher incidence of the bulbar and bulbospinal types in tonsillectomized than in nontonsillectomized patients, the ratio being 2 to 1. Postmortem studies made in 8 cases strongly suggest a pharyngeal portal of entry.

M. V. MILLER, Philadelphia.

Nose

VASCULAR DYNAMICS OF THE COMMON COLD AND ALLERGIC RHINITIS. SIMON L. RUSKIN, Ann. Otol., Rhin. & Laryng. **55**:904 (Dec.) 1946.

Ruskin believes that insufficiency of adrenin is behind the loss of constrictor tone and that ephedrine serves as an adrenin-sparing mechanism. Ascorbic acid (vitamin C), through its reducing properties, has a sparing action on both epinephrine and ephedrine and enhances the action of these substances in overcoming nasal congestion clinically. The mechanism of the actual muscle contraction that gives vasoconstriction is closely tied up with a series of chemical reactions involving the vitamin B complex. Through the intermediation of these enzymes in cell respiration, energy is obtained from ingested carbohydrates. Imbalance between the amount of carbohydrate and the available vitamin B complex leads to accumulation of fatigue-producing pyruvic acid. This may also explain the tendency for increased susceptibility to colds to follow heavy indulgence in carbohydrates. Muscle tone is controlled by the B complex in conjunction with adenylic nucleotide. Another factor involved in muscle metabolism and vasoconstriction is the inorganic ion influence and electrolytic balance. Permeability of the capillary walls is perhaps the greatest factor in the vascular dynamics of the common cold, and this is in direct relationship with the calcium level and the hydrogen ion concentration of the circulating fluids, a high calcium level and an alkaline state increasing the resistance to capillary leakage.

The indications for treatment based on physiologic and clinical investigation point to the use of ephedrine for adrenin-sparing, ascorbic acid for intercellular cementum, preferably as ephedrine acrobate, and acrobic acid as the calcium and sodium salts for alkalinity.

M. V. MILLER, Philadelphia.

1. PENICILLIN AND OSTEOMYELITIS OF THE SUPERIOR MAXILLA OF THE INFANT. 2. PENICILLIN AND OSTEOMYELITIS OF THE SUPERIOR MAXILLA OF THE CHILD. J. TERRACOL, Y. GUERRIER and J. CHALMETON, Ann. d'oto-laryng. **64**:40 and 44 (Jan.-Feb.) 1947.

The two papers are presented by the authors in the same issue.

In one paper they report 2 cases in which an infant recovered from osteomyelitis of the superior maxilla as a result of penicillin therapy.

They advocate the use of early and large doses of penicillin, to be given both intramuscularly and intravenously, in such infections. This therapy offers the best chance for the prevention of the formation of abscesses, fistulas and sequestrums, as well as for the prevention of the destruction of the dental root buds. In the chronic stages they find penicillin to be less efficacious. Therapy should be continued sufficiently long to overcome the possibility of recurrences and relapses. In the stages of sequestration one should resort to surgery in conjunction with penicillin therapy. One should also consider the use of the sulfonamides as synergists in the therapeutic program of such cases.

In the second paper the problem of osteomyelitis of the superior maxilla as it occurs in the child is discussed. Two cases are presented, in one of which the disease terminated fatally. In this instance the child was deprived of continued penicillin therapy, owing to objections offered by the parents, who resorted to the services of a "healer."

The authors believe that the prognosis is most favorable when young diploic bone and bone of membranous origin, as found in the cranium, are involved. For

this reason the superior maxilla is more sensitive to penicillin than the mandible, which is a more compact bone.

VIOLE, Beverly Hills, Calif.

Miscellaneous

TRANSMISSION OF POLIOMYELITIS BY PATIENT TO PATIENT CONTACT. A. E. CASEY and W. I. FISHBEIN, J. A. M. A. **129**:1141 (Dec. 22) 1945.

Casey and Fishbein, in their study of patient to patient transmission of poliomyelitis, found that of 66 persons who had been in contact with patients during the infectious period, 37 had illnesses within six to fifteen days afterward which were compatible with poliomyelitis. Of 109 other children of the same age who resided within the same block as a patient but who had not been in contact with the patient during the infectious period, 4 had illnesses compatible with poliomyelitis, and none had the classic form of the disease.

Of 115 control children who were of the same age as the contacts and noncontacts but who lived 10 and 50 blocks distant from the poliomyelitis neighborhood and were apparently without contact with any patient who had the disease in any clinical form, 5 had illnesses compatible with poliomyelitis, and none had the disease in any clinical form. There was no statistically significant difference between the noncontacts and the controls in this respect, but there was a highly significant difference between these two groups and the contact group.

The authors came to the following conclusions: Multiple occurrences of poliomyelitis in the family were the rule rather than the exception when there were other children from 1½ to 8½ years of age in the home. 2. Poliomyelitis was contagious perhaps to the degree of 90 per cent in the 1½ to 3½ year age group but was less so in the older groups. 3. There was no evidence that flies and other insects played a major role in the spread of the disease in the neighborhoods studied, once the disease had been introduced. 4. In only about 1½ out of 6 cases of poliomyelitis would the disease have been diagnosed as such, even under an alert public health reporting system, without an intensive neighborhood study. In the other cases of poliomyelitis the illness was generally so mild that a physician was not consulted. 5. Paralysis developed in about 1 case in 6, and in about 2 cases in 6 the diagnosis could be confirmed only by inoculating animals or by determining the protein content of the spinal fluid two to seven weeks after onset. 6. In the cases studied poliomyelitis was usually mild, but in every instance there was sufficient systemic disturbance to account for thorough immunization. Even in the mildest cases the protein of the spinal fluid was above 45 mg. per hundred cubic centimeters two to six weeks after onset. 7. Earlier observations by Casey, Aycock, Kessel and Gordon on the infectious and incubation periods are confirmed, and the original high percentage of patient to patient contacts noted in a rural epidemic is substantiated by finding the same conditions in a large urban area like Chicago in a nonepidemic year. 8. Present methods and criteria for the diagnosis of the disease must be revised.

ALPERS, Philadelphia.

A STUDY OF THE ORIGIN OF AN EPIDEMIC OF POLIOMYELITIS. M. L. SMITH, E. M. BRIDGE, H. E. UNDERWOOD and G. E. DALE, J. A. M. A. **129**:1150 (Dec. 22) 1945.

Smith and her co-workers made a study of the origin of an epidemic of poliomyelitis. The work covered the circumstances surrounding the development of

the first 3 paralytic cases of poliomyelitis in the 1944 epidemic in the Buffalo area. The evidence indicates that these cases did not arise *de novo* but were relatively late developments in a cycle which had been in progress, but unsuspected, for approximately three months. Although a period of five and one-half months elapsed between the last reported case of the preceding season and the first of the 1944 epidemic, the interval was only two months prior to the earliest minor illness in 1944 which, on the basis of circumstantial evidence, was caused by the virus of poliomyelitis. In view of the difficulties in recognizing such minor illnesses, it is probable that the virus was continually active in the area throughout the entire period between the two cycles. The incidence of illnesses in the community which were highly suggestive of being nonparalytic forms of the disease was at least five times that of recognized poliomyelitis. The week by week distribution of these suggestive illnesses followed the same general pattern as the reported cases, but began earlier in the season and extended later. Other minor illnesses, simulating ordinary gastrointestinal and respiratory tract infections, were also widely prevalent. Although no laboratory studies were made, the evidence presented suggested that the Buffalo epidemic was initiated and spread largely through direct human sources, and not from polluted sewage, streams, toilets or unsanitary environmental conditions. It is suggested that the definition of an epidemic of poliomyelitis be broadened to include the preparalytic and postparalytic phases of the cycle.

ALPERS, Philadelphia.

THE SYNDROME OF BILATERAL VESTIBULAR PARALYSIS. J. G. CHUSID and C. G. DE GUTIERREZ-MAHONEY, J. Nerv. & Ment. Dis. **103**:172 (Feb.) 1946.

The role of the vestibular apparatus as an integral part of the mechanism of reflexes for righting, maintenance of posture and compensatory ocular movements was demonstrated by Magnus, while James, in 1882, showed that the clinical picture of complete loss of vestibular function was marked by difficulty in balancing in the dark, inability to swim and dive, especially with the eyes closed, and lack of subjective response to rapid whirling. The authors report 4 cases of the syndrome of bilateral vestibular paralysis, in 3 of which the causes were scrub typhus (mite-born typhus), scarlet fever and syphilis, respectively. The etiologic factor in the fourth case was obscure. The clinical syndrome was characterized by: staggering and a broad-based gait when the patient was walking in the dark or with the eyes closed; disorientation in the water, especially with the eyes closed; inability to maintain ocular fixation when the head was moving; absence of vertigo, unsteadiness, nausea, nystagmus and past pointing on rotary and caloric tests for labyrinthine function.

CHODOFF, Washington, D. C.

GUIDES FOR NERVE REGENERATION ACROSS GAPS. PAUL WEISS and A. CECIL TAYLOR, J. Neurosurg. **3**:375 (Sept.) 1946.

Weiss and Taylor report the results of their animal experiments on the regeneration of nerves across gaps too extensive for primary end to end anastomosis. Gaps as great as thirty times the diameter of the severed nerves were bridged with use of arterial sleeves or collagen tubes, filled with a blood core. In one series, large numbers of leukocytes were added to the core to increase the liquefaction of the blood. Regeneration of fibers was excellent so long as the tubes remained patent. The longer the tube they used, the greater was the degree of collapse. To avoid this, fiber cores of glass wool, nylon, textile rayon, cellulose acetate and

"cordura" (tire rayon) were added to the sleeves or tubes. As long as these cores were in direct contact with the regenerating nerve, growth progressed. The fibers were then attached to both the proximal and the distal nerve stump by direct insertion into the nerve ends. Along these guide lines the growth of the nerve progressed in straight, parallel lines. The authors conclude that "aside from technical failures, excellent nerve regeneration was obtained by blood bridges. Functional recovery and histological appearance proved that in many cases the results were not inferior to those after end-to-end union."

TOZER, Philadelphia.

A TEST OF LIP READING ABILITY. JEAN UTLEY, J. Speech Disorders 11:109, 1946.

A list of 100 words was compiled from Thorndike's list of most frequently used words by extracting every tenth word from the first 1,000 words. To this was added a sentence test made up of 10 trial statements, 50 common expressions and 20 idiomatic sentences. The tests were first administered to a group of 200 subjects of normal hearing arranged so that the subjects had to lip read the material. Even the youngest child could score on the test. After the material had been arranged in apparent order of difficulty, the revised tests were administered to 110 students in two schools for the deaf, all known to have at least third grade reading ability. The handicapped group showed a higher degree of proficiency in lip reading than even the best group of normal subjects. Six paragraphs were then selected from the Gates reading tests and added to the former two tests. This material did not contribute statistically. The tests were then shortened by removing the most complicated and the simplest material. The material for sentence and word tests was then photographed on black-and-white 16 mm. film, and story tests were added in technicolor. Each test situation was followed by a fifteen second period of black film to allow the subject to write what he thought he saw said.

The tests, as described, were then administered to 761 persons 8 to 21 years of age from the first to the twelfth grade with the age of onset of deafness ranging from birth through 15 years. From 702 of these subjects data concerning the cause were available: 303 had "acquired" deafness; 256 "congenital" deafness, 135 "unknown" deafness and 8 otosclerosis. The general lip reading ability of these hard of hearing children was reported by teachers. The conclusions were as follows: 1. The skills of word, sentence and story recognition are interrelated. There is a great deal of overlapping among the various skills, yet the combined skills do not represent a single unitary ability; word, sentence and story recognition should be measured separately for diagnostic purposes. Ability to lip read sentences can be predicted more reliably from ability to lip read stories than from ability to lip read words; ability to lip read words can be more reliably predicted from ability to lip read sentences than from ability to lip read stories; and ability to lip read stories can be more reliably predicted from ability to lip read sentences than from ability to lip read words. 2. The internal reliability of each type of test was shown to be high enough for practical purposes. The coefficient for the sentence test was 0.928; that for the word test, 0.797, and that for the three tests as a whole 0.943. 3. Reliable prediction of lip reading ability cannot be made from teachers' judgment ratings. 4. Lip reading ability cannot be predicted from reading level or school achievement, nor from chronologic age, age of onset of deafness or grade placement. 5. The best criterion to be used as the basis for the standardization of a test of lip reading ability is the distribution of scores in percentile ranks. 6. It was not possible to arrange the test items in any order of difficulty. The successes

and errors made by the final group tested are distributed evenly throughout the three tests. The highest scores were obtained from a higher over-all response; poorer scores were mainly due to failure with one or another specific group of items.

PALMER, Wichita, Kan.

MY MILESTONES. HARRIS P. MOSHER, Laryngoscope **56**:736 (Dec.) 1946.

Dr. Mosher ruminates on some of the outstanding work done by him when he was chief of the Massachusetts Eye and Ear Infirmary. Among the items discussed are the surgical treatment of the ethmoid labyrinth, the tear sac operation, thrombosis of the cavernous sinus, the pharyngomaxillary fossa, various conditions of the throat and the esophagus, and brain abscess. It goes without saying that the article is most worth while.

HITSCHLER, Philadelphia.

HODGKIN'S DISEASE IN CHILDREN. HERMAN CHARACHE, New York State J. Med. **46**:507 (March) 1946.

Hodgkin's disease is comparatively rare in children. At the time this article was written, 233 cases had been recorded in the literature. The author adds 11 additional cases from the Brooklyn Cancer Institute, briefly reviews the literature and includes a complete bibliography of the subject. The symptoms, the diagnosis, the treatment and the prognosis are discussed.

Even to a greater degree than in adults, the disease in children is commoner in males than in females (82.7 to 17.3 per cent). Eight of the patients whose cases are recorded by Charache were infants between the ages of 2 and 5 months. Hodgkin's disease is rare in Negro children. The reverse should be true if tuberculosis is a precursor of the disease, since tuberculosis is more prevalent in that race.

A swelling of the neck is usually the first symptom, and the left cervical glands are more frequently involved. It is believed that all cases begin with abdominal involvement and that the disease then spreads to the other lymph nodes. Mediastinal involvement is commoner in children than in adults, whereas the reverse is true of cutaneous manifestations. The blood picture is not diagnostic.

The only positive basis for diagnosis is the histologic study of an excised gland. The treatment of choice is irradiation.

The prognosis for children is poor, even graver than for adults. The average duration of the disease in the recorded cases was approximately two years.

AIKMAN, Rochester, N. Y.

THE SYNDROME OF PHYSICAL OR INTRINSIC ALLERGY OF THE HEAD: III. VASOMOTOR RHINITIS AND THE VASODILATING SYNDROME; THEIR RELATIONSHIP TO MYALGIA AND ENDOLYMPHATIC HYDROPS (MÉNIÈRE'S DISEASE). H. L. WILLIAMS, Proc. Staff Meet., Mayo Clin. **21**:58 (Feb. 6) 1946.

Williams attempted to determine whether association of the four symptom complexes—myalgia, vasodilating pain, endolymphatic hydrops (Ménière's disease) and vasomotor rhinitis—was frequent enough "to be attributed to some factor other than chance." He studied 362 cases in which one of these diagnoses had been established. In 122 of these cases, or in more than one third, some association of two or more of the syndromes was apparent. The factor in common appears to be mechanical, physical or intrinsic allergy. The symptoms of the various conditions can be relieved by nicotinic acid in a large percentage of cases.

ALPERS, Philadelphia.

MIGRAINE AND THE SYMPATHETIC NERVOUS PATHWAYS. G. F. ROWBOTHAM, Brit. M. J. **2**:319 (Sept. 7) 1946.

It is generally agreed that the pain of migraine is probably due either to excessive spasm or to dilatation of the arteries of the scalp and the dura mater, but the reason for this excessive spasm or dilatation has remained conjectural. It has been suggested that a migrainous person is born with an unstable mechanism in the hypothalamus which reacts excessively to the multitudinous stimuli and causes explosive or dysrhythmic messages to be sent to the large blood vessels of the head. Rowbotham reasoned that if these disordered messages from the hypothalamus are transmitted by the motor autonomic pathways to the vessels concerned, section of those pathways should give relief. He tested this hypothesis on 4 patients with migraine, removing part or all of the upper cervical sympathetic ganglion, stripping the outer coats of the common internal and external carotid arteries and ligating and dividing the external carotid artery. He was able to obtain complete relief in 3 of the 4 patients for a period of several months to over a year after operation. The other patient stated his belief that the operation was of some help, but he still had headaches. Rowbotham attributes failure in the fourth case either to the possibility that the unstable mechanism lay in the vessels rather than in the hypothalamus or to removal of the whole rather than only the lower half of the cervical sympathetic ganglion.

On the assumption that the pain of migraine arises in the arteries of the head from excessive spasm or dilatation, that in some cases the pain is transmitted to the brain through the upper part of the posterior root of the trigeminal nerve and that the arterial spasm is aroused by dysrhythmic messages passing along the motor sympathetic pathways, Rowbotham has constructed a neural mechanism to account for many of the phenomena of migraine.

ECHOLS, New Orleans,

DEFECTIVE SPEECH IN CHILDREN. P. HENDERSON, Practitioner **156**:119 (Feb.) 1946.

The author discusses the development of speech, the incidence of speech defects and the relation of intelligence to speech defects. The statutory provisions for children handicapped by defective speech in England and Wales are briefly listed and discussed. Speech defects of childhood are classified as follows:

1. Stammering. Several current theories of the cause of stammering are listed in this interesting discussion.

2. Defects or articulation.

   (*a*). Dyslalia: Defective pronunciation of consonants.

   (*b*). Rhinolalia: Nasal speech.

      Rhinolalia aperta, in which the nasopharynx is not closed by the soft palate, as in cleft palate, and all speech sounds except *m*, *n* and *ng* are incorrectly produced.

      Rhinolalia clausa, in which there is nasal obstruction due to a deflected nasal septum, nasal polypi, enlarged turbinate bones, enlarged adenoids or neoplasm.

   (*c*). Cluttered, hurried and jumbled speech.

   (*d*). Idioglossia: Articulation so defective that the patient appears to have a language of his own; this type of speech is characteristic of persons with low grade mentality and of children with congenital auditory imperception.

(*e*). Dysarthria, due to imperfect coordination of the muscles of the lips, the tongue, the larynx or the palate; the seventh, the tenth or twelfth cranial nerves or their nuclei may be involved.

3. Defects of voice: Aphonia and dysphonia. Complete and intermittent loss of voice may be organic, as after tracheotomy, or functional, as in hysteria or severe chorea.
4. Aphasia: Congenital word deafness. It occurs but is rare in children. Neurologic and psychologic classifications are included under this heading.
5. Defects due to amentia.
6. Defects due to deafness.
7. Retarded speech. If a child is late in talking, an investigation should be made of the hearing, the mental development and the emotional status. The author makes suggestions with respect to therapy and the ages at which therapy should be instituted and gives the qualifications and the status of speech therapeutists in Britain.

FERDINAND, Peoria, Ill.

GLOSSOPHARYNGEAL NEURALGIA TREATED BY TRANSTONSILLAR SECTION OF THE NERVE. C. P. WILSON and D. MCALPINE, Proc. Roy. Soc. Med. **40**:82 (Dec.) 1946.

The glossopharyngeal nerve of a woman aged 47 was exposed in the tonsillar fossa after removal of the right tonsil; it was divided and ⅜ inch (0.95 cm.) removed, with relief of typical glossopharyngeal neuralgia.

The syndrome is characterized by paroxysmal pain referred to the back of the tongue and the tonsillar area, radiating to the ear and having a trigger zone. The transtonsillar approach is recommended if the trigger zone is in the tonsillar area, the intracranial approach being a last resort if the newer method fails to give relief. Another indication for the use of this approach, which is described by the authors as surgically simple, is failure to demonstrate a primary condition causing the neuralgia, such as an elongated styloid process pressing into the tonsillar bed.

BERRY, Philadelphia, ARCH. NEUROL. & PSYCHIAT.

INTRATHECAL ADMINISTRATION OF PENICILLIN. CONSTANCIO CASTELLS, JORGE GHERARDI and J. C. GIANNETTO, An. de oto-rino-laring. d. Uruguay **16**:25, 1946.

The authors have injected penicillin intrathecally in a series of patients—in some with normal spinal fluid and in others with pathologic fluid. They used both concentrated and dilute solutions of penicillin. For the first group the concentration was 10,000 units of penicillin diluted in 1 cc. of isotonic sodium chloride solution; for the second group they used 10,000 units of penicillin in 10 cc. of isotonic sodium chloride solution. Observations were made on these patients immediately before the injections and then at intervals of either one, two, four or six days. In each case there was a definite increase of albumin and globulin, a reduction of sugar, an increase of chlorides and an increase of cellular elements. The difference in the two groups was of degree. On conclusion of the series of examinations they believed that (1) intrathecal injection of penicillin produces definite changes in the spinal fluid; (2) these changes are influenced by the concentration of penicillin; (3) there is no appreciable influence of the various vehicles used in diluting penicillin; (4) a daily second injection of this solution

does not necessarily influence the change in the spinal fluid; on the other hand, there is an appearance of xanthochromia and red blood cells; (5) the reaction is purely a reactive meningismus due to the penicillin; (6) these facts are to be borne in mind so as to evaluate the underlying pathologic condition and to suspend intrathecal therapy when the symptoms become aggravated; (7) the effect of the intrathecal injection of penicillin can simulate the appearance of meningitis, if this therapy is used without logical indications and before a positive diagnosis of meningitis is noted.

PERSKY, Philadelphia.

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

John R. Lindsay, M.D., *President*
Lawrence J. Lawson, M.D., *Secretary*
Regular Monthly Meeting, Jan. 5, 1948

Electrocardiographic Changes Following Laryngectomy. Presented by Dr. Carl A. Johnson, Dr. Paul Holinger and Dr. Albert Andrews.

This study was undertaken after one of us had noted the frequency with which gallop rhythm followed laryngectomy for carcinoma. It was thought that there was more postoperative cardiac disturbance than from many other major operations. We were interested in the study of pulmonary and cardiac reflexes, particularly in their bearing on angina, in patients of this type with permanent tracheotomy openings. None of the patients had a history of anginal attacks or had anginal attacks following surgical treatment.

The limitations of the electrocardiogram as a means of the study of cardiac function are recognized; changes may occur following many conditions and procedures in the absence of organic cardiac disease. In spite of this it was thought that some information might be obtained on immediate, late, reflex and toxic effects of this operation, as well as on the genesis of various components of the electrocardiogram.

All patients studied had had a previous biopsy diagnosis of carcinoma of the larynx, and were in the age group from 40 to 80 years. Some had evidence of cardiovascular disease prior to surgical intervention. The type of operations were laryngectomy and laryngofissure, depending on the extent of the lesion and the age and the condition of the patient. Anesthesia was induced by intratracheal inhalation mainly of mixtures of ether, cyclopropane and nitrous oxide. Its duration varied from one hundred and fifty to two hundred and eighty-five minutes. Postoperative care did not differ from that following most major operations; penicillin was given routinely unless there were allergic contraindications, in which case sulfadiazine was substituted. Patients were fed a liquid diet through a retained stomach tube. Frequent aspirations of the trachea were made by suction. In those cases in which acute atelectasis developed from plugging of a bronchus, a hard blow over the area usually sufficed to relieve the condition.

In the group of 49 patients on whom laryngectomy was performed there was no mortality. The morbidity varied, the average hospital stay being from two weeks to one month. The electrocardiographic changes [illustrated by slides] were mainly changes of the amplitude and the contour of the QRS complex, changes of the ST segment and changes of the T wave. In some instances the changes were mainly in one lead; in others they occurred in more than one lead. The changes were not uniform, nor was the time of onset. In some the changes occurred shortly after operation; in others, several days later. In some cases changes were progressive until the patient left the hospital; in others the tracing

had returned to the appearance of the control electrocardiogram. About 90 per cent of the patients showed these changes.

It is difficult to speculate on the causes of the various changes observed, particularly the late effects. The type and the method of administration of the anesthetic mixture have been quite uniform, although the duration of administration and the combination of anesthetic agents varied with each case. The early effects of ether in the ordinary operation are known to be premature beats, paroxysmal auricular tachycardia and disturbance of the pacemaker. However, no reference could be found to any late effects. Even less is known of the effects of the various combinations of anesthetic agents used in this series. So far as we are able to determine, the combinations used were chosen from clinical experience, not as a result of any scientific experiments demonstrating their late effects on the cardiovascular system. The procedure of administration of the anesthetic agent is that of necessity; it does reduce the dead air space of the respiratory tract, and little if anything is known as to whether this may be a factor in producing the changes observed. Other studies will be needed following other operations to determine whether similar results are obtained. This study suggests the importance of a statistical study of the effects of individual anesthetic agents, as well as various operative procedures, to determine what factors are responsible for the long period of recovery.

One would surmise that the changes observed in electrocardiograms in this series are the result of toxic, reflex and traumatic influences, as well as of the adjustment of the pulmonary physiology which follows this operation.

DISCUSSION

Dr. Paul Holinger: This subject has been of interest to us during the past three years since Dr. Johnson has assumed the medical management of those of our patients who undergo laryngectomy. In some of the 49 cases the operative procedure was relatively long. In some simple laryngectomy was done, with use of a clamp; in others a more radical operation was carried out, with the hyoid bone and tracheal rings being resected with the entire larynx; there were also cases in which irradiation had been done previously, but the tumor had recurred. The duration of the operation was not found to be related specifically to the degree of change noted in the electrocardiogram. The duration consisted of the total time that elapsed from the start of anesthesia, not from the time of incision. Further, the type of anesthesia cannot be correlated with the changes. All anesthetics were given by persons of the department of anesthesiology through an intratracheal tube, and a tube was used in the trachea when the trachea was finally opened after dissection of the larynx. Further work must be done on other operative procedures and on various types of anesthesia in other operations involving the vagus nerve or its branches.

I think one of the important points of this paper is that we need and can have assistance in these cases. We allow the medical consultant to say when the patient is ready for surgical treatment and when he can get up and begin some activity after surgical treatment. We rely on the consultant's findings, of which these studies Dr. Johnson has presented form an important part, rather than on how the patient feels and what his temperature chart shows.

Dr. Robert Lewy: I think it well worth while to emphasize the value of teamwork between the medical man and the surgeon. I am sure that in the long run morbidity and mortality rates will be influenced favorably. Some years ago I saw in the electrocardiogram of a man who had just recovered from a serious

attack of scarlet fever combined with streptococcic pneumonia, changes essentially comparable to those shown here. It was more isoelectric than it had been prior to the illness, and the QRS complex showed less wide variations and the T wave was considerably flattened in leads II and III. This suggests to me that any insult to the human organism, whether medical or surgical, would be responsible for causing these changes. One should study not only the variables involved in the surgical approach but also the influence of toxemia, infection and medical conditions, for a better perspective of the problem.

Dr. Alfred Lewy: In the days when intubation for laryngeal diphtheria was fairly common there were a number of cases in which death occurred in the attempt at intubation, in some cases as soon as the epiglottis was palpated. It was attributed to a cardiac reflex, but I do not believe any one worked out the sequence. Perhaps one of the essayists can explain what happened.

Dr. Francis Lederer: Laryngectomy imposes quite a trial on the patient. It is a formidable procedure in which there is not only a traumatic influence but a change in the entire physiologic picture, and it is not surprising to see these changes in the electrocardiogram. Dr. Lewy's remarks remind me that many diphtheritic patients died following tracheotomy as well as during intubation. I believe in such instances the patient had myocardial damage, and death was due to this, and not to a reflex; that the patient had respiratory embarrassment and finally was subjected to this procedure.

I would second Dr. Robert Lewy's remarks concerning the worth while aspect of medical and surgical cooperation; there is need for more of it.

Dr. Alfred Lewy: The type of case to which I referred was that in which sudden death occurred almost immediately when the larynx was touched. I do not know whether in the presence of diphtheria there was myocardial damage, but the deaths were too sudden—it seemed as if there were a nerve reflex of some sort.

Dr. John Lindsay: With the great development of surgery as related to the chest in the last couple of decades, one wonders whether in such procedures as removal of part of the esophagus and pneumonectomy there are similar changes in the electrocardiogram.

Dr. Carl A. Johnson: I first became interested in this subject while I was a medical student, when it came to my attention that some of the fraternities used a form of the Valsalva experiment in initiations. This consisted of having the subject take a deep breath and hold it while compression of the chest was applied. It was noted that unconsciousness could be produced easily by this procedure. Dr. Luckhardt and I did some work on dogs at the University of Chicago and confirmed other work to the effect that raised intrapulmonic pressure produces a marked fall in blood pressure and change in the heart rate, and in some dogs sudden death occurred. Sudden death could be prevented by induction of anesthesia, by administration of morphine or atropine or by section of the vagi. This is in keeping with the work of Dr. Joseph Capps, who showed that sudden death of a patient undergoing thoracentesis could be prevented by giving morphine and atropine before the procedure. He also showed that the reflexes were exaggerated when the tissues were inflamed. The sudden death of the infants mentioned by Dr. Lewy may have been on this basis.

Our study is only preliminary in nature, and offers a method of study of operative and postoperative factors which have a bearing on prolonged morbidity. There has been no mortality in this series. One patient had delayed atrioventricular conduction and bundle branch block, and went through the surgical opera-

tion easily, while others, whose electrocardiograms looked more normal, had difficulty. The significance is hard to evaluate, especially when one considers the electrocardiogram to be a composite of all electrical changes in the body at the instant of deflection. The major changes in the electrical record are, however, the result of cardiac action.

DR. A. H. ANDREWS: In answer to Dr. Lindsay: In the work done by Ivy on section of the vagi, about 40 per cent of the dogs died immediately of asphyxiation. This could be prevented by administration of atropine, and the heart could be started by contact massage. It has been thought for many years that sudden death due to stimulus about the pleura is based on this mechanism, and in the presence of acute inflammation this particular reflex was more apt to occur.

The Vibration of Vocal Folds at Selected Frequencies. Presented by I. P. BRACKETT, PH.D., of the department of speech correction and audiology, Northwestern University.

The present study was concerned with the vibration of the vocal folds of 2 men phonating at 256, 128 and a glide between 128 and 256 cycles per second. The action of the vocal folds at these frequencies was photographed at 4,000 pictures per second. The results were obtained from a frame by frame analysis of the films. The analysis of the action of the vocal folds was achieved by studying the glottal openings during the cycle of vibration, the phase relationship of the cycle, the adjustment of the superior laryngeal structures and the length of the glottis on successive frames of the cycle. All results were taken from composite tracings of the six times enlarged film images.

The results of the study indicate that the cycle of vibration consisted of three phases: closed, opening and closing. After the closed phase of the cycle, the first observable opening appeared slightly anterior to the center of the folds and moved predominantly in an anterior-posterior direction as well as laterally during the opening phase of the cycle. The closing phase of the cycle moved in a posterior-anterior direction. At comparable frequencies and intensities, subject 1 consistently had a larger glottal area than subject 2, but in both subjects the glottal area was greater for 128 than for 256 cycles per second.

At 256 cycles per second both subjects had a phase relationship of one-third closed, one-third opening and one-third closing. At 128 cycles per second subject 1 continued to have the same proportion of frames for the phases of the cycle, while subject 2 had one fourth of the frames for the closed phase, three eights of the frames for the opening phase and three eights for the closing phase. At the completion of the glide (frequency 256) subject 1 showed one half of the frames for the closed phase and approximately one fifth of the frames for the opening and closing phases of the cycle. There is evidence that differences in glottal area as a function of time and differences in the proportion of time for the three phases of the cycle may be related to the type of voice production.

For both subjects the area of the visible folds was greater at 256 than at 128 cycles per second. During the glide, subject 1 decreased the area of the observable folds between the frequencies of 128 and 256, while subject 2 increased the area of the observable folds in phonating the same glide.

The glottal length for a given subject also appeared to vary at comparable frequencies and intensities. Differences in glottal length, glottal area and the proportion of time for the phases of the cycle appeared to be related to the type of voice production.

The study reveals that further investigation is indicated to study the vibratory action of the folds during different types of usage of the voice.

DISCUSSION

DR. PAUL MOORE: It may be wondered why a study of this kind should be made. It is one of several which have been completed, and it is a part of a contemplated series dealing with the function of the larynx as observed during the production of voice. If laryngologists can discover how the normal and abnormal larynxes produce sound they may be able to develop more effective remedial programs.

There are some interesting implications in Dr. Brackett's study. One relates to the theories of vocal cord vibration. Although the present investigation involves a glottal opening, this space is directly related to the movement of the cords. The fact that they have remained closed for a certain portion of each vibratory cycle and then open to emit a puff of air lends support to the "puff" theory. This theory receives further support from another finding in the study, namely, that the relative time occupied by the three phases of the vibratory cycle may vary without changing the pitch of the tone, provided the glottis opens at the proper frequency.

Another point of interest related to pitch is the sizes of the larynxes of the 2 subjects photographed. One subject was much larger than the other and had a larger larynx; yet both produced the same pitches. The photograph indicates that muscular tension differed considerably between pitches in the same subject and between the two subjects at the same pitches. There is a strong suggestion that laryngeal adjustments related to air pressure determine the rate of movement of the cords.

Some of the photographs also cause one to believe that loudness is directly related to the area attained by the glottis during the vibratory cycle and the air pressure. Subsequent study may provide answers to such surmises.

In practice laryngologists regularly see laryngeal pathologic conditions which produce defective voices. They also see patients as my colleagues and I do, who have voice defects without demonstrable laryngeal deviations. We are vitally interested in both types and hope that our research will prove beneficial to the related fields. I should like to point out that the subjects used in Dr. Brackett's study were necessarily trained to tolerate and to manipulate a guttural mirror in a manner not possible for a naive subject. We are working toward more universal technics and will welcome any suggestion laryngologists care to make.

DR. PAUL HOLINGER: I should like to compliment the essayists on this work. Theirs is the sort of paper one is anxious to have presented before this group, since it follows so logically the preliminary work presented last year. The extremely complicated and interesting technic of photography used leaves one envious, and I should like to know if there are any tricks the essayists have along that line about which they could tell the laryngologists. My associates and I have had our greatest stumbling blocks with mirror photography in these areas. The possibility of further study of the influence of deformity or the changes produced by various types of disease comes to mind immediately. This method adds an entirely new approach to a problem which interests us all.

DR. WALTER H. THEOBALD: I wonder whether the cord changes from E to G string, for example, when the subject changes from 256 to 128 cycles per second.

DR. I. P. BRACKETT: It is difficult to determine exactly the length of the vocal folds for different frequencies because the superior laryngeal structures often

limit the view. It is commonly thought that the vocal folds increase in length as the pitch is raised, and on the films they appear to do so. The relationship between the length of the folds and the length of the glottal opening has not been determined. The ends of the glottis are not always visible during the opening and closing phases of the cycle, so that one cannot be certain that the ends of the glottis, when the glottal opening is at its greatest, correspond to the ends of the vocal folds. There is evidence that the length of the glottis may not be related to the length of the folds at a given frequency. The type of voice production appears to affect the glottal area (length and width), although the exact relationship has not been determined.

There is substantial difference in tension of the vocal folds for different frequencies. At 128 you can see a definite "ripple," a sign of laxity, which starts anterior to the center of the folds and spreads across their superior surface until the glottis is at its widest. The "ripple" disappears as the folds begin the closing phase. At 256 the "ripple" cannot be seen. The vocal folds are definitely more taut at 256 than at 128.

Dr. John R. Lindsay: What happens to the opening when you increase the intensity?

Dr. I. P. Brackett: I cannot answer that. The speed and noise of the camera made it difficult to be certain of the exact intensity of the voice. The voice intensities varied slighlty in the present research but not enough to enable one to draw any conclusions. This research was an attempt to vary frequency at comparable intensities. I hope sometime to vary intensity at constant frequencies.

Book Reviews

Diseases of the Nose, Throat and Ear. By I. Simson Hall, M. B., Ch. B., F. R. C. P. E., F. R. C. S. E. Pp. 463. Price $4.50. Baltimore: The Williams & Wilkins Company, 1948.

"This volume is designed to meet the needs of the busy general practitioner and the student and it is strictly limited to this aim." In accomplishing this expressed goal, the author is highly successful.

This fourth edition has been principally motivated by the recent advances in penicillin therapy and in the fenestration operation. Following the format of previous editions, it gives a general introduction to knowledge of the more common diseases encountered in the ear, the nose and the throat. No attempt is made to describe in detail diseases that require a high degree of special training to recognize.

Each section is preceded by a brief anatomic review and offers a concise but comprehensive discussion of the causation, the diagnosis, the pathology, the treatment and the complications of the common diseases affecting the ear, the nose and the throat. In the concluding chapter some 4 pages are devoted to a thoughtful perspective on the extent to which the sulfonamides and penicillin should be used in the fields of otolaryngology. No mention is made of streptomycin. Since the author refers the reader to larger volumes for more detail, he includes neither footnotes nor a bibliography in this book.

A brief chapter on artificial hearing aids implies that recent American advances in aural rehabilitation have not yet been fully appreciated in the author's experience. He states that some 80 to 85 per cent of young patients will find most satisfactory results with the fenestration operation. Cases of Ménière's disease are classified as cases of essential and cases of secondary disease, depending on whether the disease is caused by an alteration of intralabyrinthine pressure or by the results of middle ear disease, respectively.

The general practitioner will find in this book careful evaluations of many common diseases, all of which are concisely but accurately described and well presented.

Vertigo: A Physiopathologic Study. By Dr. Adolfo Azoy, chief professor of otoneurology in the Municipal Neurologic Institute of Barcelona, Spain, Pp. 193, with 27 illustrations. Price 50 pesetas (approximately $4.50). Barcelona, Spain: Manuel Marin, 1948.

This monograph on vertigo is exhaustive and well written. In the first chapter the author discusses some general anatomicophysiologic facts concerning the vestibular apparatus and supplements this discussion with a description of the normal reactions of the labyrinth. The chapters are all graphically illustrated and are extremely relevant. A considerable amount of space is devoted to physiologic vertigo or sea sickness, as also to vertigo of aviation. Chapter 4 deals with Ménières disease and chapter 5 with Ménière's syndrome. The author discusses these two subjects in detail, particularly from the etiologic standpoint. Chapter 6 deals with

the therapy of the various forms of vertigo. Finally there is an extensive bibliography, which is cited freely throughout the text. The book is printed on good paper and exhibits a comprehensive present day conception of this difficult subject.

Penicillin in Oto-Rhino-Laryngology. By J. Terracol, professor of the Faculty of Medicine of Montpellier, and J. Lapouge, laryngologist to the Hospital of Nice. Pp. 152. Paris: Mason & Cie, 1947.

A review of the medical and surgical application of penicillin is presented in a booklet of 152 pages, with brief reports of cases illustrative of dosages and results.

Following are the various phases discussed: the history of the discovery of penicillin and its preparation, its chemical structure, its constituents and its mode of action. The antipenicillins are mentioned as well as the various preparations of pencillin. The behavior of penicillin in the organism, the titration of penicillin in the blood, the routes of its administration, as well as the accidents and incidents in its administration, and the toxicity are considered.

This monograph is devoted to the important question of penicillin as it concerns the otorhinolaryngologist. All of the modalities of its administration, with their advantages and disadvantages, are described. Separate chapters are devoted to the various clinical entities in otolaryngology, with case reports and with a review of the literature.

The Ear, Nose and Throat. George D. Wolf, M.D. Price $10. Pp. 479. Philadelphia: J. B. Lippincott Company 1948.

This book, based on an elaboration of symptoms, is indeed worth while for the undergraduate medical student and the general practitioner

It is well written, simple, concise, and contains a wealth of information. The important recent literature has been well reviewed, and the historical footnotes are interesting and accurate.

Details of operations are of necessity left out, and hence the book cannot be of too great value to the graduate student or to the specialist in otolaryngology.

The illustrations and photographs are exceedingly good and well chosen.

The chapter on the lacrimal apparatus in relation to the rhinologic approach is especially well done.

In general it might be said that this compact volume could well serve as an auxiliary text in any medical school and as a ready reference book in the library of the busy general practitioner.

Report of the Medical Research Council (British) on Hearing Aids and Audiometers. Pages 75. Price 2 shillings, 3 pence. His Majesty's Stationary Office London: 1947.

This paper-bound booklet of 75 pages is an up-to-date breviary on practical acoustics as applied to hearing aids and audiometers. There is an effort almost identical with that put out by the Harvard group to determine ideal standards for a hearing aid suitable for general use. (The socialist government has already under way the manufacture, under contract, of a standard aid which is dispensed gratis to the hard of hearing. The pamphlet contains a considerable amount of scientific data that have been worked up by acoustic engineers and the book re-

sembles in this respect the reports from the Bell Laboratories, the American Standard Association, the Research Council, the American Acoustical Society and similar literature published in the United States. As a matter of fact, many of the matters described were initiated in this country—standardizing audiometers, testing the performance of hearing aids, construction of the artificial ear. It is notable and worth while to realize and appreciate that at least the two great English-speaking nations are matching their technics and making them identical. It will mean that tests made in either nation will be readily understood and interpreted in the other. Such consideration of others has not existed before in the field of acoustics, and is an example of international cooperation of great future scientific promise.

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